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>
> Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).
>
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>
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>
> For related information see also *34 Fluid Mechanics and Heat Transfer.*

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76 SOLID-STATE PHYSICS 401

Includes superconductivity.

For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 406

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.

Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 408

Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 409

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.

Includes cost effectiveness studies.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY 410

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 412

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.

For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 412

89 ASTRONOMY 412

Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 ASTROPHYSICS 414

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

For related information see also *75 Plasma Physics.*

91 LUNAR AND PLANETARY EXPLORATION 415

Includes planetology; and manned and unmanned flights.

For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

92 SOLAR PHYSICS 415

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation.*

93 SPACE RADIATION 416

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

99 GENERAL 416

Note: N.A. means that no abstracts were assigned to this category for this issue.

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TYPICAL CITATION AND ABSTRACT

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ACCESSION NUMBER	**N89-11793*#** Draper (Charles Stark) Lab., Inc., Cambridge, Mass.	**CORPORATE SOURCE**
TITLE	**CONTROL OF FLEXIBLE STRUCTURES-2 (COFS-2) FLIGHT CONTROL, STRUCTURE AND GIMBAL SYSTEM INTERACTION STUDY Final Report**	
AUTHORS	Stanley Fay, Stephen Gates, Timothy Henderson, Lester Sackett, Kim Kirchwey, Isaac Stoddard, and Joel Storch Sep. 1988 205 p	**PUBLICATION DATE**
CONTRACT OR GRANT	(Contract NAS9-17560)	
REPORT NUMBERS	(NASA-CR-172095; R-2088; NAS 1.26:172095) Avail: NTIS HC	**AVAILABILITY SOURCE**
PRICE CODE	A10/MF A01 CSCL 22B	**COSATI CODE**

The second Control Of Flexible Structures Flight Experiment (COFS-2) includes a long mast as in the first flight experiment, but with the Langley 15-m hoop column antenna attached via a gimbal system to the top of the mast. The mast is to be mounted in the Space Shuttle cargo bay. The servo-driven gimbal system could be used to point the antenna relative to the mast. The dynamic interaction of the Shuttle Orbiter/COFS-2 system with the Orbiter on-orbit Flight Control System (FCS) and the gimbal pointing control system has been studied using analysis and simulation. The Orbiter pointing requirements have been assessed for their impact on allowable free drift time for COFS experiments. Three fixed antenna configurations were investigated. Also simulated was Orbiter attitude control behavior with active vernier jets during antenna slewing. The effect of experiment mast dampers was included. Control system stability and performance and loads on various portions of the COFS-2 structure were investigated. The study indicates possible undesirable interaction between the Orbiter FCS and the flexible, articulated COFS-2 mast/antenna system, even when restricted to vernier reaction jets. Author

VOLUME 27 NUMBER 3 / FEBRUARY 8, 1989

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N89-11689# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JOURNAL OF CHINESE SOCIETY OF ASTRONAUTICS (SELECTED ARTICLES)
Kuide Luo 10 May 1988 34 p Transl. into ENGLISH from Yuhang Xuebao (People's Republic of China), no. 1, Jan. 1987 p 16-28; 116-117
(AD-A196019; FTD-ID(RS)T-0092-88) Avail: NTIS HC A03/MF A01 CSCL 01B

Contents include: The weighted average functionality of the HTPB binder and its correlativity with the best curing parameter of solid propellants; and solid rocket propulsion conference. GRA

N89-11690# Boeing Commercial Airplane Co., Seattle, Wash.
WORLD JET AIRPLANE INVENTORY AT YEAR-END 1987
Mar. 1988 83 p
(PB88-191168) Avail: NTIS HC A05/MF A01 CSCL 01B

Data in this edition of the World Jet Airplane Inventory reflect, as accurately as possible, the status of the world's commercial jet airplane fleets (including some military derivatives) at the end of the year 1987. The World Jet Airplane Inventory is composed of a selected number of computer printouts from JETTRACK, a computer-based jet airplane inventory system kept by the Market Research Department of Boeing Commercial Airplane Company. Fleet data in this system are obtained from many different sources, including airframe manufacturers, airplane owners and operators, governments, and trade publications. The document provides details for announced orders, deliveries, and inventories for all commercial jet airplanes built in the United States and Western Europe with a capacity of 60 seats and up. In addition, the year-end 1987 inventory data in Sections 4 and 6 include non-Russian operators of the Tupolev-134 and larger passenger airplanes build in the USSR. Announced jet airplane orders are summarized in Section 1. Orders that were placed and later cancelled are treated as if they never occurred. The tabulations include all airplanes that were never sold but are (or were) used exclusively for the manufacturers' private purposes, such as flight testing, route proving, and short-term leasing. GRA

N89-11691# Federal Aviation Administration, Washington, D.C. Office of Management Systems.
CENSUS OF US CIVIL AIRCRAFT: CALENDAR YEAR 1987 Annual Report
31 Dec. 1987 346 p
(AD-A196626; FAA-AMS-420) Avail: NTIS HC A15/MF A01 CSCL 01C

This report presents information about the U.S. civil aircraft fleet. It includes detailed tables of air carrier aircraft and an inventory of registered aircraft by manufacturer and model, and general aviation aircraft by state and county of the owner. GRA

N89-11692* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY (SUPPLEMENT 230)
Sep. 1988 160 p
(NASA-SP-7037(230); NAS 1.21:7037(230)) Avail: NTIS HC A08; NTIS standing order as PB88-914100, $8.50 domestic, $17.00 foreign CSCL 01A

This bibliography lists 563 reports, articles and other documents introduced into the NASA scientific and technical information system in August, 1988. Author

N89-11693# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AVIATION AND SPACE NEWS
24 Jun. 1988 11 p Transl. into ENGLISH from Hangkong Zhishi (Peoples Republic of China), no. 12, Dec. 1986 p 607
(AD-A197702; FTD-ID(RS)T-0286-88) Avail: NTIS HC A03/MF A01 CSCL 01C

The initiation of development of MD-11 and MD-90 passenger airplane is discussed, along with the upgrade plan for extended-range TriStar passenger airplane. Other topics of articles are: CAT sets new record, Rolls-Royce and Pratt-Whitney joint venture supersonic VTOL engine, A Sudan civilian airplane crashed, no survivers, A Honduras Air Force C-130 crashed, Solid Rocket Propellant Conference held in Jiujiang, China aviation photos exhibited in Changchun, A memorable get-together-The first Aviation Summer Camp for the Youths of Jilin Province, First Aviation Summer Camp for Youths held in Hubei Province, International Defense Technology Exhibition in Beijing. GRA

N89-11694*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLOW-FIELD SURVEY OF AN EMPENNAGE WAKE INTERACTING WITH A PUSHER PROPELLER
W. Clifton Horne and Paul T. Soderman Oct. 1988 54 p
(NASA-TM-101003; A-88185; NAS 1.15:101003) Avail: NTIS HC A04/MF A01 CSCL 01B

The flow field between a model empennage and a 591-mm-diameter pusher propeller was studied in the Ames 7- by 10-Foot Wind Tunnel with directional pressure probes and hot-wire anemometers. The region probed was bounded by the empennage trailing edge and downstream propeller. The wake properties, including effects of propeller operation on the empennage wake, were investigated for two empennage geometries: one, a vertical tail fin, the other, a Y-tail with a 34 deg dihedral. Results showed that the effect of the propeller on the empennage wake upstream of the propeller was not strong. The flow upstream of the propeller was accelerated in the streamwise direction by the propeller, but the empennage wake width and velocity defect were relatively unaffected by the presence of the propeller. The peak turbulence in the wake near the propeller tip station, 0.66 diameter behind the vertical tail fin, was approximately 3 percent of the free-stream velocity. The velocity field data can be used in predictions of the acoustic field due to propeller-wake interaction. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N89-11695# National Aeronautical Lab., Bangalore (India). Aerodynamics Div.
VORTICAL FLOWS ON THE LEE SURFACE OF DELTA WINGS
K. Y. Narayan and S. N. Seshadri Jun. 1988 13 p
(TM-AE-8802) Avail: NTIS HC A03/MF A01

In the more than three decades of research on the lee surface flow of delta wings, starting from the identification of a single pair of counterrotating vortices springing from the leading edges, multiple vortices (secondary, tertiary), squashed vortices, vortices embedded in boundary layers, shock waves on the wing, on, underneath, and in between the vortices, shock wave boundary layer interaction, shock-induced separation, vortex bursting, asymmetric flow behavior and so on have been progressively discovered. In a gross sense, the geometric and free stream condition under which each of these flow phenomena occurs are reasonably well understood. However, the physical mechanisms underlying some of the flow phenomena remain far from clear. Significant progress has been made in recent times in the computation of the complex 3-D flows of delta wings; however, solutions for even the simplest flow type (flow with a pair of leading edge vortices) tax the resources of the largest available computer. Solutions for the more complex flow types including multiple separations, shocks, etc., appear to be realizable only in the distant future. Author

N89-11696 Old Dominion Univ., Norfolk, Va.
DIRECT SIMULATION OF HYPERSONIC TRANSITIONAL FLOWS OVER BLUNT SLENDER BODIES Ph.D. Thesis
Vincent Cuda, Jr. 1987 115 p
Avail: Univ. Microfilms Order No. DA8805575

Hypersonic transitional flow was studied using the Direct Simulation Monte Carlo method. The cylindrically blunted wedge and spherically blunted cone were examined for body half angles of 0, 5, and 10 degrees, at a flight velocity of 7.5 km/s, zero angle of incidence and altitudes of 70 to 100 km. Those geometries and flow conditions are important considerations for hypersonic vehicles currently under design. Surface chemistry was examined for diffuse, finite-catalytic surfaces. Nonequilibrium chemistry and nonequilibrium thermodynamics were considered for both configurations at all altitudes. Numerical simulations showed that rarefied gas effects, such as surface temperature jump and velocity slip, exist. Slip conditions were more significant for the axisymmetric cases and the onset of chemical dissociation occurred first for the two-dimensional configuration ay 96 km. Comparisons between the numerical simulation and viscous shocklayer calculations at the higher altitudes show significant differences in the calculated heat-transfer rate, body drag and flowfield structure. A comparison with hypersonic wind tunnel heat-transfer rate data showed good agreement. Dissert. Abstr.

N89-11697# National Aeronautical Lab., Bangalore (India). Fluid Mechanics Div.
FLOW VISUALISATION OF LEADING EDGE VORTICES ON A DELTA WING BY LASER SHEET TECHNIQUE
P. R. Gopinath, S. Sundaram, K. T. Madhavan, S. R. Siddalingappa, and K. S. Yajnik Mar. 1988 21 p
(PD-FM-8804) Avail: NTIS HC A03/MF A01

A technique for illuminating a section of the flow past a delta wing uses a sheet of light obtained while expanding a laser beam by passing it through a cylindrical lens system. This report gives the results of the first application of this technique in the National Aeronautical Laboratory (NAL). A delta wing of aspect ratio 0.53 was placed in the NAL boundary layer tunnel at various incidences up to 35 deg and sideslip angles up to 20 deg. The freestream speed was 3 m/s, the chord Reynolds number being 0.53 x 10 to the 5th. Smoke was introduced upstream of the apex of the wing model. Vertical planes at 40 to 75 percent of chord were illuminated by the laser sheet by traversing the laser. The cross sections of the flow within the vortices above the delta wing model and also downstream of the trailing edge were photographed. The pictures show sharp vortex cores changing into diffused cores over a relatively small distance. There is a secondary instability of shear layer visibility in some photographs especially in the transition region. Author

N89-11698*# Vigyan Research Associates, Inc., Hampton, Va.
ADAPTIVE WALL TECHNOLOGY FOR MINIMIZATION OF WALL INTERFERENCES IN TRANSONIC WIND TUNNELS
Stephen W. D. Wolf Washington NASA Nov. 1988 30 p
(Contract NAS1-17919)
(NASA-CR-4191; NAS 1.26:4191) Avail: NTIS HC A03/MF A01 CSCL 01A

Modern experimental techniques to improve free air simulations in transonic wind tunnels by use of adaptive wall technology are reviewed. Considered are the significant advantages of adaptive wall testing techniques with respect to wall interferences, Reynolds number, tunnel drive power, and flow quality. The application of these testing techniques relies on making the test section boundaries adjustable and using a rapid wall adjustment procedure. A historical overview shows how the disjointed development of these testing techniques, since 1938, is closely linked to available computer support. An overview of Adaptive Wall Test Section (AWTS) designs shows a preference for use of relatively simple designs with solid adaptive walls in 2- and 3-D testing. Operational aspects of AWTS's are discussed with regard to production type operation where adaptive wall adjustments need to be quick. Both 2- and 3-D data are presented to illustrate the quality of AWTS data over the transonic speed range. Adaptive wall technology is available for general use in 2-D testing, even in cryogenic wind tunnels. In 3-D testing, more refinement of the adaptive wall testing techniques is required before more widespread use can be planned. Author

N89-11699 Colorado State Univ., Fort Collins.
COHERENT RAMAN SPECTROSCOPY FOR SUPERSONIC FLOW MEASUREMENTS Ph.D. Thesis
Gregory Charles Herring 1987 121 p
Avail: Univ. Microfilms Order No. DA8808946

Inverse Raman spectroscopy is used to measure non-intrusively the velocity, temperature, and density in a supersonic nitrogen gas flow. The present measurement uses two lasers, operating at different visible frequencies, to drive coherently the vibrational resonances in the flowing N2. A miniature wind tunnel produces the Mach 2 supersonic flow. Flow velocities are determined by measuring the flow induced Doppler shift of the Q-branch vibrational Raman transitions, while the rotational temperature is deduced from the relative strengths of two adjacent rotational lines in the Q-branch. Densities are obtained using the temperature measurement along with a measurement of the relative strength of a single rotational transition between the unknown flow density and a known reference density. Statistical measurement uncertainties are approximately 3 percent for velocities, 3 percent for temperatures, and 10 percent for densities. The measurements are in general agreement with the approximations of a one-dimensional supersonic flow model. Dissert. Abstr.

N89-11700 Arizona Univ., Tucson.
A TRUNCATION ERROR INJECTION APPROACH TO VISCOUS-INVISCID INTERACTION Ph.D. Thesis
Brian Dean Goble 1988 153 p
Avail: Univ. Microfilms Order No. DA8809936

A numerical procedure is presented which uses the truncation error injection methodology to efficiently achieve accurate approximations to complex problems having disparate length scales in the context of solving viscous, transonic flow over an airfoil. The truncation error distribution is estimated using the solution on a coarse grid. Local fine grids are formed which improve the resolution in regions of large truncation error. A fast fourth-order accurate scheme is presented for interpolating and relating the solutions between the generalized curvilinear coordinate systems of the local and global grids. It is shown that accurate solutions can be obtained on global grids. It is shown that accurate solutions can be obtained on a global coarse grid with correction information obtained on local fine grids, which may or may not be topologically similar to the global grid as long as they are capable of resolving the local length scale. Dirichlet boundary conditions for the local grid yield the best results. The scheme also serves as the basis of a local refinement technique wherein a grid local to the nose of an airfoil is used to resolve a supersonic zone terminated by a shock and its interaction with a turbulent boundary layer. The solution on the local grid reveals details of the shock structure and a jet-like flow emanating from the root of the normal shock in the shock boundary layer interaction zone. Dissert. Abstr.

N89-11701 Tennessee Univ., Knoxville.
FREE WAKE ANALYSIS OF HELICOPTER ROTOR BLADES IN HOVER USING A FINITE VOLUME TECHNIQUE Ph.D. Thesis
Ramachandran Krishnamurthi 1987 96 p
Avail: Univ. Microfilms Order No. DA8810370

In the computation of helicopter rotor flow fields, wake effects can be very important since each blade passes close to the wake produced by the preceding ones, cause a large local effect. Also, the vortical flow from the wake of a number of blade passages causes a large global effect. A method was developed which like integral methods does not constrain or spread the wake. Also, like finite difference methods, it can treat compressibility effects. This method was developed into a computer program for the computation of rotor flow fields in hover with free wakes. The method utilizes a finite volume potential flow technique. The basic approach involves modifying the potential flow wake treatment so that, within the numerical approximation, the momentum is conserved there as in the rest of the flow field. Results computed by this approach for the circulation and wake geometry are compared with experimentally measured data. Cases treated include subsonic and transonic flows, high and low aspect ratios, and two and four bladed rotor configurations. Dissert. Abstr.

N89-11702 Tennessee Univ., Knoxville.
ROLL-UP OF A VORTEX SHEET TRAILING FROM A VORTEX GENERATOR Ph.D. Thesis
Peter August Liver 1987 150 p
Avail: Univ. Microfilms Order No. DA8810372

The roll-up of a vortex sheet trailing from an airfoil type vortex generator was investigated through various analytical models. The effects of a finite size vortex sheet and the effects of viscosity on the vortex trajectory are included as important factors. The problem is treated as two-dimensional with the streamwise direction being replaced by the time coordinate assuming that the streamwise gradients are small compared to the development in the crossflow plane. The strength and the distribution of vorticity in the wake sheet trailing from the vortex generator are determined using a modified vortex lattice approach. The influence of the airfoil represented by its camber distribution and the effects of the velocity profile of the oncoming boundary layer are investigated. The effects of finite size of the initial vortex sheet and the associated finite formation rate of the trailing vortex are isolated by employing an inviscid vortex sheet roll-up calculation. Viscous effects on the vortex strength and on the trajectory are included by the application of the vorticity-streamfunction form of the Navier-Stokes equations. Dissert. Abstr.

N89-11703 Texas A&M Univ., College Station.
AN INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF PLANAR AND NON-PLANAR OUTBOARD WING PLANFORMS Ph.D. Thesis
Dinesh Anthony Naik 1987 233 p
Avail: Univ. Microfilms Order No. DA8808807

The outboard planforms of wings have been found to be of prime importance in studies of induced drag reduction. This conclusion is based on an experimental and theoretical study of the aerodynamic characteristics of planar and nonplanar outboard wing forms. Seven different configurations, baseline rectangular, elliptical, swept and tapered, swept and tapered with dihedral, swept and tapered with anhedral, rising arc, and dropping arc were investigated for two different spans. Span efficiencies as much as 20 percent greater than baseline can be realized with nonplanar wing forms. Optimization studies show that this advantage can be achieved along with a bending moment benefit. However, parasite drag and lateral stability estimations were not included in the analysis. The induced drag benefits are believed to accrue from the movement of vorticity away from the center of span line. Self-induced velocity components from the nonplanar lifting surface could conceivably alter the downwash distribution enough to lower the induced drag. The importance of wake curvature to account for the nonplanar alignment of the vortex sheet is also stressed. Flow surveys show the vortex roll-up. An extensive comparison of the separated flow behavior of the configurations is also documented with flow visualization photographs. Dissert. Abstr.

N89-11704 Florida Univ., Gainesville.
A SELF-ADAPTIVE COMPUTATIONAL METHOD FOR TRANSONIC TURBULENT PROJECTILE AERODYNAMICS Ph.D. Thesis
Christopher William Reed 1987 116 p
Avail: Univ. Microfilms Order No. DA8809680

An adaptive grid generation procedure is developed for viscous flow problems. The adaptive equations are based on a variational statement resulting in a set of elliptic equations in which adaptation can occur independently in each coordinate direction. The method allows for explicit control of adaptation and orthogonality while grid smoothness is implicit in the elliptic equations. The adaptive grid generation equations retain a simple relationship between the control functions and the grid point spacing, are capable of efficiently providing the extremely refined mesh in the boundary layer regions and can maintain a smooth grid network in complex geometries. A self-adaptive computational technique has been developed by coupling the adaptive grid generation procedure with a thin layer Navier-Stokes code and a TVD code. In solving an axisymmetric turbulent transonic projectile flow problem, the grid network was adapted to the pressure distribution in the steamwise direction and to the velocity distribution in the direction normal to the projectile sUrface. Results obtained for Mach 0.91, 0.96, and 1.2 indicate that the procedure can provide good adapted grid networks provided good choices are made for the control functions. Dissert. Abstr.

N89-11705 Rensselaer Polytechnic Inst., Troy, N.Y.
DISCRETE VORTEX MODELING OF A BLADE-VORTEX INTERACTION Ph.D. Thesis
Piergiovanni Renzoni 1987 270 p
Avail: Univ. Microfilms Order No. DA8808188

An unsteady, two-dimensional, parallel blade-vortex interaction model was developed using discrete free-vortex method and classical potential flow theory. The tip vortex was modeled by a single vortex for middle to far interaction regions and by a cluster of vortices for close encounters and vortex impingment. The analysis allows for the airfoil to move either steadily or unsteadily through the fluid and allows for a freely convecting wake. Comparisons of this nonlinear, unsteady analysis for both periodic and transient airfoil motions are made to the existing linear airfoil theories. While it is found that the nonlinear effects are small for a small amplitude periodic motion as a reduced frequency of unity, it is found that they cannot be disregarded in general. The results of a detailed study of numerous blade-vortex interactions are correlate into simple equations for incremental lift and moment coefficients. Comparisons with linear theory, advanced numerical methods, and a two-dimensional parallel blade-vortex interaction experiment were made. Dissert. Abstr.

N89-11706 California Univ., Davis.
VELOCITY-SCALAR pdf METHODS FOR TURBULENT SHEAR FLOWS WITH TWO-POINT TIME SCALES Ph.D. Thesis
Arthur Cheng-Hsin Wu 1987 81 p
Avail: Univ. Microfilms Order No. DA8809799

The transport equations for the pdf of velocity and scalars are analyzed in the Lagrangian and Eulerian frames. A closed form of the two-time pdf is developed. The time scale for the turbulent velocity fluctuations is determined from the integral of auto-correlation in time as being proportional to the Langrangian micro-time scale. Thus no equation for the dissipation rate or another quality for the calculation of time scale has to be solved together with the pdf equation. The method of numerical solution of the closed version of the pdf equation is a stochastic simulation technique, and the model is applied to two cases: a homogeneous turbulence and a turbulent plane mixing layer. Dissert. Abstr.

N89-11707 Rensselaer Polytechnic Inst., Troy, N.Y.
THE EFFECT OF INCIDENT WAKE FLOW ON BLUNT-BODY TRANSFER RATES Ph.D. Thesis
Neil Thomas VanDresar 1987 235 p
Avail: Univ. Microfilms Order No. DA8808200

Presently, a large degree of understanding is involved in predicting heat transfer rates at the leading edge of a gas turbine airfoil. A principal cause of this uncertainty is considered to be the improper modeling of the unsteady incident flow. The unsteady nature of the flow is primarily due to turbulent wakes from the upstream row which pass over the leading edge of the airfoils. The effect of a wake-generated, incident turbulent flow upon the local transfer rate at the stagnation regions was conducted using a simplified experimental model. Measurements of the velocity, turbulence intensity, intermittency, and integral length scale within the wake are presented to quantify the turbulence characteristics of the incident wake flow. Comparison with the mass transfer results indicates that the increase in mass transfer from the cylinder along the wake centerline depends on the turbulence intensity, length scale, and possibly other factors. In addition, a simple quasi-steady theory is developed to account for the unsteady effects caused by the passing of wakes in the incident flow on the stagnation transfer rate at the leading edge of a gas turbine airfoil. Dissert. Abstr.

N89-11708# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
MODIFICATION OF AN UNSTEADY TRANSONIC SMALL DISTURBANCE PROCEDURE TO ALLOW A PRESCRIBED STEADY-STATE INITIAL CONDITION Interim Report, Jan. 1987 - Jan. 1988
Don W. Kinsey Jan. 1988 61 p
(AD-A196744; AFWAL-TR-88-3022) Avail: NTIS HC A04/MF A01 CSCL 01A

Many attempts have been made to extend the useful range of the 2-D unsteady transonic small disturbance procedure, called LTRAN2. This report describes another such extension. LTRAN2 modifications are described that allow the procedure to determine the geometry corresponding to a prescribed pressure distribution. This new geometry would account for all compressible and viscous effects, and would, therefore, be a much better starting point for the unsteady calculations. We present the transonic small disturbance governing equations and boundary conditions. Then the modifications required for the inverse geometry definition are described. Results for three different airfoils (NACA 0012, NACA 64A010, and NLR 7301) are presented and discussed. The NACA 0012 and NLR 7301 results are much improved using this procedure. GRA

N89-11709# Naval Postgraduate School, Monterey, Calif.
DYNAMIC STALL ANALYSIS UTILIZING INTERACTIVE COMPUTER GRAPHICS M.S. Thesis
Eric L. Pagenkopf Mar. 1988 90 p
(AD-A196812) Avail: NTIS HC A05/MF A01 CSCL 12E

A Navier-Stokes problem solver, developed by L. N. Sankar, is modified to provide dynamic, interactive graphical presentations of predicted flow field solutions about a NACA-0012 airfoil section oscillating in pitch, in order to demonstrate the capabilities of dynamic graphics applications in the study of complex, unsteady flows. Flow field solutions in the form of pressure coefficient and stream function contour plots about an airfoil experiencing dynamic stall are plotted utilizing an IRIS 3000-series workstation and Graphical Animation System (GAS) software, developed by Sterling Software for NASA. These full cycle solutions, in conjunction with dynamic surface pressure distribution plots and integrated lift, pitching moment and drag coefficient data, are compared to existing experimental data in order to provide an indication of the validity of the code's far-field solution. Full procedural documentation is maintained in order to provide an efficient analysis tool for use in future oscillating airfoil studies planned by the NASA-Ames Fluid Mechanics Laboratory and the Naval Postgraduate School Department of Aeronautics and Astronautics. GRA

N89-11710# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PEAK POWER AND BLADE LOADS ON STALL-REGULATED ROTORS AS INFLUENCED BY DIFFERENT AIRFOIL FAMILIES
J. L. Tangler and P. K. C. Tu Aug. 1988 9 p Presented at the AWEA/RETSIE Symposium, Santa Clara, Calif., 7 Jun. 1988
(Contract DE-AC02-83CH-10093)
(DE88-001190; SERI/TP-217-3334; CONF-8806205-1) Avail: NTIS HC A02

At the Solar Energy Research Institute (SERI), new airfoils have been developed to help improve the performance and economics of horizontal-axis wind turbines (HAWTS). The objective of this study was to compare the performance characteristics of one of these airfoil families to other commonly used airfoil series for a typical three-bladed, stall-regulated HAWT. The traditional airfoil series chosen for comparison with SERI's new thin airfoil family were the NACA 23XXX, NACA 44XX, and NASA LS(1). The Micon 110 wind turbine was chosen because it is a typical three-bladed, stall-regulated rigid rotor system. The performance characteristics of the different airfoil series were derived analytically using the Eppler airfoil design code in the analysis mode. On a relative basis, this approach to comparing airfoils was considered more accurate than using airfoil performance characteristics based on wind-tunnel test data. After generating the performance characteristics for each airfoil series, the subsequent rotor performance and blade loads were calculated using SERI's PROPSH computer code. Resulting annual energy output, which is dependent on the wind-speed distribution, was calculated using SERI's Systems Engineering and Analysis Computer Code (SEACC). The results of the study show that fixed-wing airfoils generally result in excessive peak power for stall regulated, rigid rotors. By operating the wind turbine at a less desirable blade pitch angle, peak power can be reduced at the expense of higher mean blade loads and lower annual energy output. In contrast, the thin airfoil family was designed to reduce peak power at optimum blade pitch to minimize blade loads and maximize annual energy output. DOE

N89-11711# General Dynamics/Fort Worth, Tex.
UNSTEADY LOW-SPEED WINDTUNNEL TEST OF A STRAKED DELTA WING, OSCILLATING IN PITCH. PART 3. PLOTS OF THE ZEROTH AND FIRST HARMONIC UNSTEADY PRESSURE DISTRIBUTIONS (CONCLUDED) AND PLOTS OF STEADY AND FIRST HARMONIC UNSTEADY OVERALL LOADS Final Report, Jun. 1985 - Aug. 1987
A. M. Cunningham, Jr., R. G. Den Boer, C. S. Dogger, E. G. Geurts, and A. J. Persoon Apr. 1988 194 p
(Contract F33615-85-C-3013)
(AD-A197541; AFWAL-TR-87-3098-Pt-3) Avail: NTIS HC A09/MF A01 CSCL 01A

This report contains results of a wind tunnel test of an oscillating straked wing. It provides unsteady airloads and pressure distributions for a range of incidences (-8 to 50 deg.) and amplitudes (1 to 16 deg.). The wind speed was 80 meters/second, which provided reduced frequencies up to 0.50 based on root chord. The zeroth and first harmonic as well as the continuous time history of the pressure and overall loads were measured. Flow visualization was performed for flow of 30 meters/second using a pulsating laser light sheet. In this part, appendix A presents the remainder of the unsteady zeroth and first order harmonic components of the unsteady pressure distribution plots for which the preceding runs were given in appendix B of part 2. In appendix B, plots of the steady and the zeroth and first order harmonic components of the unsteady overall loads are presented. These results are presented as functions of angle of attack, frequency and amplitude in various forms for all measured components. GRA

N89-11712# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

WIND HINDRANCE ON THE EASTERN SCHELDT (NETHERLANDS) STORM SURGE BARRIER

R. Ross and G. InderMaur 25 Mar. 1987 13 p Presented at the 7th International Conference on Wind Engineering, Aachen, Fed. Republic of Germany, 6-10 Jul. 1987
(NLR-MP-87021-U; B8815924; ETN-88-93389) Avail: NTIS HC A03/MF A01

A wind tunnel investigation was carried out on a model of a storm surge barrier to establish wind climates on the road. This information was used as input for a vehicle behavior simulation program to assess sidewind effects. The wind tunnel results reveal the most serious barrier configurations with respect to side wind effects on the traffic on the road. The position and dimension of closing hatches have a large influence. For some configurations, the hatches in retracted (upward) position diminish the sidewinds and direct the flow in the direction of the road. Wind screen configurations were tested. The usual type of half open wind screens prove to be effective. ESA

N89-11713# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

ACCURACY OF VARIOUS WALL-CORRECTION METHODS FOR 3D SUBSONIC WIND TUNNEL TESTING

R. A. Maarsingh, Th. E. Labrujere, and J. Smith 30 Jul. 1987 17 p Presented at the AGARD-FDP Symposium on Aerodynamic Data Accuracy and Quality. Requirements and Capabilities in Wind Tunnel Testing, Naples, Italy, 28 Sep.-1 Oct. 1987
(NLR-MP-87039-U; B8809807; ETN-88-93397) Avail: NTIS HC A03/MF A01

On the basis of wind tunnel measurements on a simple, unpowered, but complete transport aircraft model in a small and a very large solid-wall test section, the accuracy of four measured boundary condition methods, as well as two classical methods, was analyzed at low speed conditions. Large reductions in the amount of in situ measured data are shown to be possible, yet yielding results which match almost with those of calculations using multiples of input data. Classical methods need not be abandoned at once in low speed solid wall testing. Higher priority should be given to the interpretation problem: the determination of the actual model reaction upon the wall-induced flow field. ESA

N89-11714# National Aerospace Lab., Amsterdam (Netherlands). Aerodynamics Div.

ON REYNOLDS NUMBER EFFECTS AND SIMULATION: REPORT OF THE REVIEW COMMITTEE OF AGARD WORKING GROUP 09

A. Elsenaaer 30 Jun. 1987 27 p Presented at the AGARD-FDP Symposium on Aerodynamic Data Accuracy and Quality. Requirements and Capabilities in Wind Tunnel Testing, Naples, Italy, 28 Sep.-1 Oct. 1987
(NLR-MP-87041-U; B8807285; ETN-88-93398) Avail: NTIS HC A03/MF A01

Reynolds number effects in transonic flow are reviewed. Two-dimensional airfoils are emphasized, but three-dimensional configurations, including delta wings and slender bodies, are discussed. Examples of the so-called aft-fixation technique to simulate the high Reynolds number pressure distribution are given. Pseudo Reynolds number effects due to the wind tunnel environment are discussed. ESA

N89-11715# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

A WIND TUNNEL INVESTIGATION AT LOW SPEED OF THE FLOW ABOUT A STRAKED DELTA WING, OSCILLATING IN PITCH

R. G. denBoer and A. M. Cunningham, Jr. (General Dynamics/Fort Worth, Tex.) Jul. 1987 17 p Presented at the Atmospheric Flight Mechanics Conference, Monterey, Calif., 17-19 Aug.1987
(NLR-MP-87046-U; B8809806; ETN-88-93400) Avail: NTIS HC A03/MF A01

A low speed wind tunnel test on a straked delta wing, oscillating in pitch, was conducted. Measurements of unsteady overall airloads and pressure distributions were performed covering a wide range of incidences (-8 to 50 deg) and amplitudes (1 to 16 deg). Most test cases were carried out at a wind speed of 80 m/sec. The zeroth and first harmonic of the pressures and overall loads were measured. Time recordings were made for study of higher harmonics, power spectra, and cross correlation functions. At 30 m/sec visualization of the unsteady flow is performed, using a smoke tube fixed to the model and a pulsating laser light sheet. A limited number of runs with maneuver-like inputs was carried out. At these runs only time recordings of the balance signal were made. The test setup and the procedures used, and examples of the results are shown. ESA

N89-11716# National Aerospace Lab., Amsterdam (Netherlands). Aerodynamic Div.

REQUIREMENTS AND CAPABILITIES IN UNSTEADY WIND TUNNEL TESTING

R. G. denBoer, R. Houwink, and R. J. Zwaan 30 Aug. 1987 29 p Presented at the AGARD-FDP Symposium on Aerodynamic Data Accuracy and Quality. Requirements and Capabilities in Wind Tunnel Testing, Naples, Italy, 28 Sep. - 1 Oct. 1987
(NLR-MP-87066-U; B8809139; ETN-88-93403) Avail: NTIS HC A03/MF A01

The accuracy required for aeroelastic applications concerning full-scale aircraft wind tunnel tests are discussed. Accuracy in unsteady wind tunnel testing is considered. ESA

N89-11717*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INTERACTIVE GRID GENERATION FOR TURBOMACHINERY FLOW FIELD SIMULATIONS

Yung K. Choo, Peter R. Eiseman (Columbia Univ., New York, N.Y.), and Charles Reno 1988 10 p Presented at the 2nd International Conference on Numerical Grid Generation in Computational Fluid Dynamics, Miami Beach, Fla., 5-8 Dec. 1988; sponsored by NASA, AFOSR and Miami Univ.
(NASA-TM-101301; E-4282; NAS 1.15:101301) Avail: NTIS HC A02/MF A01 CSCL 01A

The control point form of algebraic grid generation presented provides the means that are needed to generate well structured grids for turbomachinery flow simulations. It uses a sparse collection of control points distributed over the flow domain. The shape and position of coordinate curves can be adjusted from these control points while the grid conforms precisely to all boundaries. An interactive program called TURBO, which uses the control point form, is being developed. Basic features of the code are discussed and sample grids are presented. A finite volume LU implicit scheme is used to simulate flow in a turbine cascade on the grid generated by the program. Author

N89-11718*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THREE-DIMENSIONAL SELF-ADAPTIVE GRID METHOD FOR COMPLEX FLOWS

M. Jahed Djomehri and George S. Deiwert Nov. 1988 21 p
(NASA-TM-101027; A-88277; NAS 1.15:101027) Avail: NTIS HC A03/MF A01 CSCL 01A

A self-adaptive grid procedure for efficient computation of three-dimensional complex flow fields is described. The method is based on variational principles to minimize the energy of a spring system analogy which redistributes the grid points. Grid control

parameters are determined by specifying maximum and minimum grid spacing. Multidirectional adaptation is achieved by splitting the procedure into a sequence of successive applications of a unidirectional adaptation. One-sided, two-directional constraints for orthogonality and smoothness are used to enhance the efficiency of the method. Feasibility of the scheme is demonstrated by application to a multinozzle, afterbody, plume flow field. Application of the algorithm for initial grid generation is illustrated by constructing a three-dimensional grid about a bump-like geometry.
Author

N89-11719*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLOW VISUALIZATION TECHNIQUES FOR FLIGHT RESEARCH
David F. Fisher and Robert R. Meyer, Jr. Oct. 1988 35 p
Presented at the 73rd AGARD Symposium of the Flight Mechanics Panel on Flight Test Techniques, Edwards AFB, Calif., 17-20 Oct. 1988
(NASA-TM-100455; H-1524; NAS 1.15:100455; AGARD-Paper-20) Avail: NTIS HC A03/MF A01 CSCL 01A

In-flight flow visualization techniques used at the Dryden Flight Research Facility of NASA Ames Research Center (Ames-Dryden) and its predecessor organizations are described. Results from flight tests which visualized surface flows using flow cones, tufts, oil flows, liquid crystals, sublimating chemicals, and emitted fluids have been obtained. Off-surface flow visualization of vortical flow has been obtained from natural condensation and two methods using smoke generator systems. Recent results from flight tests at NASA Langley Research Center using a propylene glycol smoker and an infrared imager are also included. Results from photo-chase aircraft, onboard and postflight photography are presented.
Author

N89-11720# Technische Hochschule, Aachen (West Germany). Fakultaet fuer Maschinenwesen.
EXPERIMENTAL INVESTIGATION OF TRANSONIC FLOW ON WING PROFILES IN WIND TUNNELS OF REDUCED MEASUREMENT SECTION Ph.D. Thesis [EXPERIMENTELLE UNTERSUCHUNG SCHALLNAH ANGESTROEMTER TRAGFLUEGELPROFILE IN KANAELEN MIT GERINGER MESSKAMMERBREITE]
Thomas Wolfgang Franke 1987 184 p In GERMAN
(ETN-88-93233) Avail: NTIS HC A09/MF A01

Investigations of stationary flow around supercritical profiles are carried out in a wind tunnel of reduced measurement section and flexible top walls. Three-dimensional sidewall effects on pressure measurement are optically processed to evaluate flow density, velocity, and wall load tension. Wall interaction is studied by adaptation of top walls and reduction of boundary layer suction. Unsteady flow phenomena on supercritical profiles and the interaction on pressure distribution, shock oscillations and vortex configurations behind wing profiles are analyzed.
ESA

N89-11721# Technische Hochschule, Aachen (West Germany). Mathematisch-Naturwissenschaftlichen Fakultaet.
MODELING OF VORTEX LAYERS OVER DELTA WINGS WITH A VORTEX LINE ADAPTED PANEL METHOD Ph.D. Thesis [MODELLIERUNG FREIER WIRBELSCHICHTEN AN DELTAFLUEGELN MIT EINER WIRBELLINIENANGEPASSTEN PANELMETHODE]
Peter Wiemer 1987 92 p In GERMAN
(ETN-88-93235) Avail: NTIS HC A05/MF A01

Free leading-edge vortex effects over delta wings, aerodynamic characteristics, and local pressure distribution are analyzed with a panel method of higher order. Numerical simulation by dipole surfaces is performed of the flow field vortex surfaces. The panels of the vortex sheets are limited by vortex lines on the both sides. Mathematical resolution of the hydrodynamic problem is attained by the collocation method applied to the nonlinear integral equations. Kutta conditions are applied for the wing grids and Newton procedure is used for iteration of geometry independant parameter variations.
ESA

N89-11722# Institut Franco-Allemand de Recherches, St. Louis (France).
AN ULTRAFAST CINEMATOGRAPHIC METHOD TO STUDY WAKES IN A HYPERSONIC BALLISTIC WIND TUNNEL [UNE METHODE CINEMATOGRAPHIQUE ULTRA-RAPIDE POUR L'ETUDE DES SILLAGES EN TUNNEL DE TIR HYPERSONIQUE]
A. Koeneke, B. C. Jaeggy, and G. Koerber 13 Apr. 1986 28 p
In FRENCH; ENGLISH summary Presented at the AGARD Fluid Dynamics Panel Symposium on Aerodynamics of Hypersonic Lifting Vehicles, Bristol, United Kingdom, 6-9 Apr. 1987
(ISL-CO-205/87; ETN-88-93281) Avail: NTIS HC A03/MF A01

A laser equipped with an acousto-optical modulator as a source of ultra short, highly energetic pulses with high repetition rate to be used to record images in order to study the time history of flow instabilities was developed. The reception system, capable of recording the images at a sufficient rate is the basic problem in the development and use of the proposed setup. Examples of images obtained with different cameras are presented. The time interval between images is 5 microsec for projectile velocities of 3000 m/sec.
ESA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N89-11723# Systems Control Technology, Inc., Arlington, Va.
AERONAUTICAL DECISION MAKING FOR AIR AMBULANCE HELICOPTER PILOTS: LEARNING FROM PAST MISTAKES Final Report
R. J. Adams and J. L. Thompson Jul. 1988 46 p
(Contract DTFA01-87-C-00014)
(DOT/FAA/DS-88/5) Avail: NTIS HC A03/MF A01

The study is based on actual helicopter air ambulance accidents. They focus on the importance of decision making and judgement during all phases of flight. Improving safety is a responsibility shared by hospital administrators, health vendors, chief pilots, head nurses, pilots, air medics, dispatchers and physicians. These accident synopses are the first element of a multi-volume set of training materials designed to significantly reduce the helicopter air ambulance accident rate and to keep it under control. The other volumes include the following: Aeronautical Decision Making for Pilots; Aeronautical Decision Making for the Air Ambulance Helicopter; Pilots: Situational Awareness Exercises; Risk Management for Air Ambulance Helicopters Operators; and Aeronautical Decision Making for Air Ambulance Helicopter Program Administrators.
Author

N89-11724*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EMERGENCY EGRESS FIXED ROCKET PACKAGE Patent Application
Margaret A. Allen, inventor (to NASA) (Rockwell International Corp., Houston, Tex.) 9 Sep. 1988 13 p
(NASA-Case-MSC-21332-1; NAS 1.71:MSC-21332-1; US-Patent-Appl-SN-242253) Avail: NTIS HC A03/MF A01 CSCL 06K

A method of effecting the in-flight departure of an astronaut from a shuttle craft, and apparatus is presented. A plurality of removeable compartment covers are provided, behind which rocket assemblies are stowed. To actuate the system, the astronaut pulls off a tab from one of the compartments which exposes a cannister having a lanyard with a hook. The lanyard extends around a spring biased sleeve with a safety lever preventing rocket ignition until the hook is moved by the astronaut. Upward movement of the hook allows the trigger mechanism to actuate the system resulting in the rods projecting out of the hatch. When the lanyard becomes taut, a lanyard elongation detector transmits a signal to the firing mechanisms to fire the rocket. NASA

N89-11725*# California State Univ., Long Beach.
EFFECTS OF ENVIRONMENTALLY IMPOSED ROUGHNESS ON AIRFOIL PERFORMANCE Final Contractor Report
Tuncer Cebeci Jun. 1987 44 p Presented at the Von Karman Inst. for Fluid Dynamics Lecture Series on Influence of Environmental Factors on Aircraft Wing Performance, 16-18 Feb. 1987 Previously announced as N88-15778
(Grants NAG3-601; NSF MEA-80-18565)
(NASA-CR-179639; NAS 1.26:179639) Avail: NTIS HC A03/MF A01 CSCL 01A

The experimental evidence for the effects of rain, insects, and ice on airfoil performance are examined. The extent to which the available information can be incorporated in a calculation method in terms of change of shape and surface roughness is discussed. The methods described are based on the interactive boundary procedure of Cebeci or on the thin layer Navier Stokes procedure developed at NASA. Cases presented show that extensive flow separation occurs on the rough surfaces. Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N89-11726*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SIMULATOR INVESTIGATION OF THE USE OF DIGITAL DATA LINK FOR PILOT/ATC COMMUNICATIONS IN A SINGLE PILOT OPERATION
David A. Hinton and Gary W. Lohr (Embry-Riddle Aeronautical Univ., Daytona Beach, Fla.) Jun. 1988 41 p
(NASA-TP-2837; L-16457; NAS 1.60:2837) Avail: NTIS HC A03/MF A01 CSCL 17B

Studies have shown that radio communications between pilots and air traffic control contribute to high pilot workload and are subject to various errors. These errors result from congestion on the voice radio channel, and missed and misunderstood messages. The use of digital data link has been proposed as a means of reducing this workload and error rate. A critical factor, however, in determining the potential benefit of data link will be the interface between future data link systems and the operator of those systems, both in the air and on the ground. The purpose of this effort was to evaluate the pilot interface with various levels of data link capability, in simulated general aviation, single-pilot instrument flight rule operations. Results show that the data link reduced demands on pilots' short-term memory, reduced the number of communication transmissions, and permitted the pilots to more easily allocate time to critical cockpit tasks while receiving air traffic control messages. The pilots who participated unanimously indicated a preference for data link communications over voice-only communications. There were, however, situations in which the pilot preferred the use of voice communications, and the ability for pilots to delay processing the data link messages, during high workload events, caused delays in the acknowledgement of messages to air traffic control. Author

N89-11727# Federal Aviation Agency, Atlantic City, N.J.
AIRCRAFT POSITION REPORT DEMONSTRATION PLAN
Joan Grelis Jun. 1988 12 p
(AD-A196564; DOT/FAA/CT-TN88/21) Avail: NTIS HC A03/MF A01 CSCL 25B

This plan describes the Aircraft Position Report Demonstration which was designed to implement and verify an aircraft/satellite data link for aircraft position reports. The demonstration will implement the Automatic Dependent Surveillance (ADS) function which will provide frequent aircraft position updates for oceanic flights outside the coverage of land based radar. Aircraft equipped with satellite communication avionics will transmit position reports to a satellite which will relay signals to a ground receiving station. From the ground station, the messages will be sent via the Aeronautical Radio, Inc. (ARINC) network to the Federal Aviation Administration (FAA) Technical Center at the Atlantic City International Airport. The position reports will be processed and displayed on a map showing routes, sectors, and fixes at the FAA Technical Center and a remote processor and display will allow demonstrations to be viewed at Air Route Traffic Control Centers. GRA

N89-11728# Federal Aviation Administration, Washington, D.C. Office of Management Systems.
FAA (FEDERAL AVIATION ADMINISTRATION) AIR TRAFFIC ACTIVITY: FISCAL YEAR 1987 Report, 1 Oct. 1986 - 30 Sep. 1987
Nancy Trembley 30 Sep. 1987 230 p
(AD-A196625) Avail: NTIS HC A11/MF A01 CSCL 01E

This report furnishes terminal and en route air traffic activity information of the National Airspace System. The data have been reported by the FAA-operated Airport Traffic Control Towers (ATCTs), Air Route Traffic Control Centers (ARTCCs), Flight Service Stations (FSSs), International Flight Service Stations (IFSSs), Approach Control Facilities and FAA contract-operated control towers. GRA

N89-11729# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DETERMINATION OF DEFLECTIONS OF THE VERTICAL USING THE GLOBAL POSITIONING SYSTEM M.S. Thesis
Andrey Aristov 1988 52 p
(AD-A196680; AFIT/CI/NR-88-84) Avail: NTIS HC A04/MF A01 CSCL 17G

Modern astrogeodetic methods, although accurate, are inefficient and too complex to rapidly determine deflections of the vertical. This problem is the impetus for finding a more useful technique that can yield results much more quickly. The Global Positioning System (GPS), with its ability to provide coordinate differences in interferometric modes, can be used to determine these deflections. Using highly accurate coordinate differences in conjunction with orthometric height differences, one can develop a surface of the geoidal undulations as a function of latitude and longitude. Given three GPS stations, a local surface can only be approximated by a plane. With more points, however, the modeled surface will more accurately resemble the true undulation differences. From this modeled surface, one uses least squares fitting of polynomials to interpolate the 'average' partial of N with respect to phi and partial of N with respect to lambda in the survey area. Finally, the deflections zeta and eta are computed and a study of propagation of both absolute and relative errors is made. GRA

N89-11730# Lear Siegler, Inc., Grand Rapids, Mich. Inst. Div.
STRESS ANALYSIS REPORT FOR THE MICROWAVE LANDING SYSTEM (MLS) CLASS V MODIFICATION C-130 AIRCRAFT
15 Jan. 1988 58 p
(Contract F09603-85-C-1224)
(AD-A196722; ID-6216-039) Avail: NTIS HC A04/MF A01 CSCL 01C

The contents of this stress analysis report on components of the Microwave Landing System are as follows: Structural Loading Criteria; Summary of Minimum Margins of Safety; Analysis; Unoccupied Areas; Receiver Installation Models C-130E/H, WC-130E/H, HC-130H/N/P; Data Bus Coupler/Signal Splitter Installation Models C-130E/H, WC-130E/H, HC-130H/N/P; Receiver/Data Bus Coupler Installation Model C-130B; Signal Splitter/Relay Panel Installation Model C-130B; Front Antenna Installation; AFT Antenna Installation; AFT Antenna Installation; AFT Pressure Feed-Thru; Crew Occupied Areas; Top Antenna

Installation; Relay Panel Installation; Relay Panel - Models C-130E/H/B; Relay Panel - Models C-130H (Late); Relay Panel - Models HC-130H/N/P, WC-130E/H; Forward Pressure Feed-Thru. GRA

N89-11731# Naval Postgraduate School, Monterey, Calif.
HUMAN FACTORS ASPECTS OF THE TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS II) M.S. Thesis
Robert J. Tuttell Mar. 1988 84 p
(AD-A196811) Avail: NTIS HC A05/MF A01 CSCL 17G

The objective of this study was to investigate three areas of interaction between pilots and the TCAS II Collision Avoidance System in order to examine the following areas of concern: (1) pilot maneuver on traffic advisory (TA) information; (2) the effect of pilot use of the system on the miss distance between conflicting aircraft; (3) the effectiveness of an alternative design for the resolution advisory (RA) display versus the current display. The first two areas were answered with data obtained from a NASA-Ames simulation using airline crews and a Boeing 727 flight simulator. Evaluation of these data reveal 14 incidents were pilots successfully maneuvered their aircraft using TA information. Forty scenarios where the TCAS II system directed evasive maneuvers were examined. These results show that the recommended avoidance maneuvers increased aircraft miss distance in 37 cases. Alternate designs for the resolution advisory display were evaluated using military and civilian pilots reacting to a computer display simulation. These results demonstrate that a red and green RA display is more effective than the current red only RA display. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*For land transportation vehicles see *85 Urban Technology and Transportation.*

N89-11732 Stanford Univ., Calif.
INTEGRATING MATRIX SOLUTIONS OF PROBLEMS IN AEROELASTIC TAILORING Ph.D. Thesis
John Anthony Green 1987 145 p
Avail: Univ. Microfilms Order No. DA8800943

The advent of composite materials with their directional stiffness properties, renewed interest in the concept of aircraft with forward swept wings. The idea of using the ply orientation to prevent static divergence, which would otherwise be a problem, became known as aeroelastic tailoring. A solution procedure is studied. The technique is known as the integrating matrix method, and is a fast and accurate way of sovling two point boundary condition problems. The method is outlined and demonstrated by consideration of a simple example problem: a rod in torsion with different boundary conditions and with concentrated masses placed on the rod. The technique is well suited to the analysis of aeroelastic problems, and because it is a numerical method it permits the study of arbitrary geometries. The use of composite materials mandates consideration of several new design parameters: the number of plies, ply orientation, and stacking sequence. Dissert. Abstr.

N89-11733*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF UNSTEADY AEROELASTIC ANALYSIS TECHNIQUES ON THE NATIONAL AEROSPACE PLANE
Anthony S. Pototzky, Charles V. Spain, David L. Soistmann (Planning Research Corp., Hampton, Va.), and Thomas E. Noll Sep. 1988 35 p Presented at the 4th National Aerospace Plane Technology Symposium, Monterey, Calif., Feb. 1988
(NASA-TM-100648; NAS 1.15:100648) Avail: NTIS HC A03/MF A01 CSCL 01C

A presentation provided at the Fourth National Aerospace Plane Technology Symposium held in Monterey, California, in February 1988 is discussed. The objective is to provide current results of ongoing investigations to develop a methodology for predicting the aerothermoelastic characteristics of NASP-type (hypersonic) flight vehicles. Several existing subsonic and supersonic unsteady aerodynamic codes applicable to the hypersonic class of flight vehicles that are generally available to the aerospace industry are described. These codes were evaluated by comparing calculated results with measured wind-tunnel aeroelastic data. The agreement was quite good in the subsonic speed range but showed mixed agreement in the supersonic range. In addition, a future endeavor to extend the aeroelastic analysis capability to hypersonic speeds is outlined. An investigation to identify the critical parameters affecting the aeroelastic characteristics of a hypersonic vehicle, to define and understand the various flutter mechanisms, and to develop trends for the important parameters using a simplified finite element model of the vehicle is summarized. This study showed the value of performing inexpensive and timely aeroelastic wind-tunnel tests to expand the experimental data base required for code validation using simple to complex models that are representative of the NASP configurations and root boundary conditions are discussed. Author

N89-11734 Technische Hogeschool, Delft (Netherlands).
DESIGN AND EVALUATION OF DYNAMIC FLIGHT TEST MANOEUVRES Ph.D. Thesis
Jan Albert Mulder 1986 322 p
Avail: Univ. Microfilms Order No. DA8811251

The accuracy of aerodynamic model parameters estimated from measurements of dynamic flight test maneuvers depends among other things on the form of the control input signals. Several types of longitudinal and lateral control input signals were evaluated in flight using an automatic control system for precise implementation. Sample convariance matrices could be determined by repeating each type of control input signal a number of times. The performance of different types of control input signals with respect to sample standard deviations of parameter estimation errors could subsequently be compared to corresponding theoretical predictions. Significant differences were shown to exist between the performance of different types of control input signals. A technique is described for the optimization of control input signals with respect to certain norms of the information matrix. The technique applies to linear as well as nonlinear systems and is based on the representation of control input signals in terms of a finite number of orthonormal functions. It is shown that in case of linear systems the computational effort required for the optimization can be significantly reduced by computing and storing a set of so-called elementary information matrices. The parameter-state estimation problem of dynamic flight tests is discussed in detail, in the linear and in the nonlinear case. It is shown that under certain conditions the parameter-state estimation problem can be solved in two consecutive steps pertaining to the reconstruction of the state and the estimation of the aerodynamic model parameters respectively. Dissert. Abstr.

N89-11735 Rensselaer Polytechnic Inst., Troy, N.Y.
NONLINEAR EFFECTS IN HELICOPTER ROTOR FORWARD FLIGHT FORCED RESPONSE Ph.D. Thesis
Mathew Bobby Mathew 1987 245 p
Avail: Univ. Microfilms Order No. DA8808176

A method for analyzing the nonlinear behavior of relatively limber rotor blades is presented. It uses the nonrotating, uncoupled natural modes of a flat, undeformed blade in a vacuum as generalized coordinates. A principal curvature transformation is used in deriving the strain energy, which assumes small strains, but includes all elastic angular deflection terms below the fourth order. The kinetic energy is derived using a velocity component transformation. The complete nonlinear equations of motion as well as the equation for small perturbation about large deformation is given. The mathematical model is applied to a number of cases for which earlier experimental results appear in literature. Excellent correlation with experiments and the use of superposition for nonlinear systems are demonstrated. The same mathematical model is used to examine the forced response of a YUH-61A rotor blade in forward flight. The effects of higher harmonic loads, pretwist, and aerodynamic mesh size are discussed. Both displacement and bending moment results are presented. The instanteous variation of frequencies and mode spaces around the azimuth is presented and discussed. Dissert. Abstr.

N89-11736 Virginia Polytechnic Inst. and State Univ., Blacksburg.
COMBAT AIRCRAFT MISSION TRADEOFF MODELS FOR CONCEPTUAL DESIGN EVALUATION Ph.D. Thesis
Lev Alexander Malakhoff 1988 203 p
Avail: Univ. Microfilms Order No. DA8807892

A methodology is developed to address the analyses of combat aircraft attrition. The operations of an aircraft carrier task force are modeled using the systems dynamics simulation language DYNAMO. The three mission-roles include: surface attack, fighter escort, and carrier defense. The level of analysis is performed over the entire campaign, going beyond traditional single-sortie analysis level. These analysis are performed by determining several measures of effectiveness (MOEs) for whatever constraints are applied to the model. The derived MOEs include: Campaign Survivability (CS), Fraction of Force Lost (FFL), Exchange Ratio (ER), Relative Exchange Ratio (RER), Possible Crew Loss (PCL), and Replacement Cost (RC). RER is felt to be the most useful MOE since it considers the initial inventory levels of both friendly and enemy forces, and its magnitude is easy for the analyst to relate to (an RER greater than one is a prediction of a friendly force's victory). Dissert. Abstr.

N89-11737# Lear Siegler, Inc., Grand Rapids, Mich. Inst. Div.
ELECTRICAL LOAD AND POWER SOURCE CAPACITY REPORT FOR THE C-130 AIRCRAFT MICROWAVE LANDING SYSTEM (MLS) SLIASC MODEL 6216
Steve Davis 15 Jan. 1988 7 p Prepared in cooperation with Smiths Industries, Grand Rapids, Mich.
(Contract F09603-85-C-1224)
(AD-A196721; ID-6216-032) Avail: NTIS HC A02/MF A01 CSCL 17G

Power loading data, power loading for the Microwave Landing System (MLS), AC power loading for MLS equipment, dc power loading for MLS equipment, ac electrical power, dc electrical power, ac load, and dc load are discussed. GRA

N89-11738* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CONTROL SURFACE ACTUATOR Patent
Gerhard E. Seidel, inventor (to NASA) (Boeing Commercial Airplane Co., Renton, Wash.) 27 Sep. 1988 6 p Filed 23 Mar. 1987 Supersedes N87-24461 (25 - 18, p 2430)
(NASA-Case-LAR-12852-1; US-Patent-4,773,620; US-Patent-Appl-SN-028832; US-Patent-Class-244-75-R; US-Patent-Class-244-78) Avail: US Patent and Trademark Office CSCL 01C

A device which actuates aircraft control surfaces is disclosed. The actuator is disposed entirely within the control surface structure. This allows the gap between the wing structural box and the control surface to be reduced. Reducing the size of the gap is especially desirable for wings with high aspect ratio, wherein the volume of the structural box is at a premium.
Official Gazette of the U.S. Patent and Trademark Office

N89-11739# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
REVIEW OF AERONAUTICAL FATIGUE INVESTIGATIONS DURING THE PERIOD MARCH 1985 - FEBRUARY 1987 IN THE NETHERLANDS
J. B. deJonge 30 Mar. 1987 27 p Presented at the 20th ICAF Conference, Ottawa, Canada, 8-9 Jun. 1987
(NLR-MP-87022-U; B8805848; ETN-88-93390) Avail: NTIS HC A03/MF A01

Aeronautical load tests; flight simulation; crack propagation; fatigue of joints; metallic materials evaluation; manufacturing effects; full scale certification tests; composites fatigue; and nondestructive inspection are reviewed. ESA

N89-11740*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
SHAPE SENSITIVITY ANALYSIS OF FLUTTER RESPONSE OF A LAMINATED WING
Fred D. Bergen and Rakesh K. Kapania Oct. 1988 95 p
(Contract NAS1-18471)
(NASA-CR-181725; NAS 1.26:181725) Avail: NTIS HC A05/MF A01 CSCL 01C

A method is presented for calculating the shape sensitivity of a wing aeroelastic response with respect to changes in geometric shape. Yates' modified strip method is used in conjunction with Giles' equivalent plate analysis to predict the flutter speed, frequency, and reduced frequency of the wing. Three methods are used to calculate the sensitivity of the eigenvalue. The first method is purely a finite difference calculation of the eigenvalue derivative directly from the solution of the flutter problem corresponding to the two different values of the shape parameters. The second method uses an analytic expression for the eigenvalue sensitivities of a general complex matrix, where the derivatives of the aerodynamic, mass, and stiffness matrices are computed using a finite difference approximation. The third method also uses an analytic expression for the eigenvalue sensitivities, but the aerodynamic matrix is computed analytically. All three methods are found to be in good agreement with each other. The sensitivities of the eigenvalues were used to predict the flutter speed, frequency, and reduced frequency. These approximations were found to be in good agreement with those obtained using a complete reanalysis. Author

N89-11741 Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany).
COMPUTER AIDED OPTIMAL STRUCTURAL DESIGN OF STRINGERS FROM AIRBUS A310-300 WITH STARS: DETAILED OPTIMIZATION MODEL [RECHNERGESTUETZTE STRUKTUROPTIMIERUNG DES SEITENLEITWERKKASTENS VOM AIRBUS A310-300 MIT STARS: DETAILLIERTERES OPTIMIERUNGSMODELL]
K. Hertel, C. Kathmann, E. Winkler, and H. Wellen 5 May 1988 66 p In GERMAN
(MBB-UT-116/88; ETN-88-93193) Copyright Avail: Fachinformationszentrum Karlsruhe, 7514 Eggenstein-Leopoldshafen 2, Fed. Republic of Germany

Computer programs STARS and NASTRAN are used for a detailed optimization model to perform structural weighted optimization of Airbus stingers. Detailed computations are carried out with 386 design variables in view of a comparison of optimal structural programs Lagrange and STARS. Structural mechanical results indicate a width reduction of all segments of the stringers and a global weight reduction of 22 percent taking into account the stability. ESA

N89-11742# Royal Aircraft Establishment, Farnborough (England).
A REVIEW OF WORK IN THE UNITED KINGDOM ON THE FATIGUE OF AIRCRAFT STRUCTURES DURING THE PERIOD MAY 1985 - APRIL 1987
R. Cook, comp. Jan. 1988 100 p Presented at the 20th International Committee on Aeronautical Fatigue, Ottowa, Ontario, Jun. 1987 Submitted for publication
(RAE-TR-87077; RAE-MAT/STR-215; BR106674; ETN-88-93557) Copyright Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

Studies of the development and growth of fatigue damage in metals and composites, studies of crack propagation and residual strength, and work to increase knowledge of aircraft loading actions are reviewed. ESA

N89-11743# Royal Aerospace Establishment, Farnborough (England).
WING DIVERGENCE AND ROLLING POWER
Ll. T. Niblett Mar. 1988 27 p
(RAE-TR-88017; RAE-MAT/STR-221; BR107014; ETN-88-93559)
Copyright Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

The fundamental static aeroelastic properties of a swept wing which has freedom to roll are studied. It is shown that the divergence speed of a wing which can roll steadily is high or nonexistent and consequently the rolling power of any aileron varies almost linearly with dynamic pressure and, in particular, remains finite at the fixed-root divergence speed. Inboard ailerons have higher reversal speeds than outboard ailerons when the wing is swept back but the opposite is true when the wing is swept forward. ESA

N89-11744# Royal Aerospace Establishment, Farnborough (England).
INVESTIGATION OF THE EFFECTS OF PAYLOAD PODS AND AIRBRAKES ON THE LONGITUDINAL STABILITY OF THE X-RAE 2 UNMANNED AIRCRAFT IN THE 24 FOOT WIND-TUNNEL
W. J. G. Trebble Mar. 1988 32 p
(RAE-TM-Aero-2124; BR106756; ETN-88-93562) Copyright
Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

Low speed wind tunnel tests were made on a full scale model of X-RAE 2 at an airspeed of 30 m/sec to investigate the effects of payload pods and airbrakes on its drag and longitudinal stability. The payload pods and fuselage skid each give drag increments of 0.006 and an extra 3 deg up-elevator is required for trimming with the pods fitted. The airbrakes produce incremental drag coefficients of 1.15 based on their projected frontal area. All the airbrakes tested give significant loss in lift and those positioned so that they touch the fuselage side require an extra 10 deg of up-elevator for trimmed level flight. The maximum value of the lift/drag ratio is reduced from 10.9 without airbrakes to values between 5.5 and 7.6 when the airbrakes are deployed. ESA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N89-11745# Naval Research Lab., Washington, D.C.
NUMERICAL SIMULATIONS OF THE FLOWFIELD IN CENTRAL-DUMP RAMJET COMBUSTORS. PART 2: EFFECTS OF INLET AND COMBUSTOR ACOUSTICS Interim Report, Oct. 1985 - Jul. 1988
K. Kailasanath, J. H. Gardner, J. P. Boris, and E. S. Oran 8 Jul. 1988 39 p
(AD-A196743; NRL-MR-6213) Avail: NTIS HC A03/MF A01
CSCL 21E

A potentially important source of large pressure oscillations in compact ramjets is a combustion instability induced by the interaction of large-scale vortex structures with the acoustic modes of the ramjet. To study these interactions, we have performed time-dependent, compressible numerical simulations of the flow field in an idealized ramjet consisting of an axisymmetric inlet and a combustor. The simulations indicate strong coupling between the flow field and the acoustics of both the inlet and the combustor. For the cases studied, forcing at the first longitudinal acoustic mode of the combustor induces vortex-rollup near the combustor entrance at that frequency. A low frequency oscillation is also observed in all the simulations. Pressure and velocity fluctuations in the inlet indicate that the low frequency corresponds to a quarter-wave mode in the inlet. Changing the length of the inlet appropriately changes the observed low frequency. The merging pattern of the inlet is changed. These merging patterns are explained on the basis of an interaction between the vortex rollup frequency and the acoustic modes of the inlet and combustor. GRA

N89-11746# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
CONTOUR LINE NEAR TURBINE PARTS FROM NICKEL AND TITANIUM POWDER METAL (PM) MATERIALS BY ADVANCED ENCAPSULATION TECHNIQUE AND CAPSULE FREE FORMING PROCEDURE. ISOSTAT PRESSING OF PM MATERIALS Final Report [KONTURNAHE TURBINENTEILE AUF BASIS VON NICKEL- UND TITAN-PM-WERKSTOFFEN DURCH FORTSCHRITTLICHE KAPSELTECHNIK UND KAPSELFREIE FORMGEBUNGSVERFAHREN. VERBUNDISOSTATPRESSEN VON PM-WERKSTOFFEN]
Barbara Borchert, Max Kraus, Raimund Lackermeier, and Wolfgang Track Dec. 1986 58 p In GERMAN
(Contract BMFT-03-ZG-064A3)
(ETN-88-92107) Avail: NTIS HC A04/MF A01

Static and dynamic experiments carried out show that Titan 685 is well adapted to powder metallurgy and joint pressing. Metallographic investigations indicate that thermal mechanical treatment can improve the strength of the manufactured parts. Vibration strength depends highly on fabrication procedure. ESA

N89-11747# Brown, Boveri und Cie, A.G., Mannheim (West Germany). Zentrales Labor fuer Werkstofftechnik.
CERAMIC THERMAL BARRIER COATINGS FOR GAS TURBINE COMPONENTS EXPOSED TO HOT GASES Final Report
Ralf Buergel, Wing Fong Chu, Hermann W. Gruenling, Gerhard Leiter, and Franz-Josef Rohr Bonn, Fed. Republic of Germany BMFT Sep. 1987 41 p In GERMAN; ENGLISH summary
Sponsored by BMFT
(ETN-88-93227) Avail: NTIS HC A03/MF A01

Ceramic thermal barrier coatings which are sufficiently corrosion resistant under crude oil firing conditions were studied. The thermal cycling resistance should be as good as for conventional ZrO2-8Y2O3 systems. Ceramic systems based on the ZrO2-Y2O3 system, and on Al2O3-TiO2 and Al2O3-CrO3 were evaluated. Further tests were concentrated on coatings of the ZrO2-Y2O3-SiO2-(Al2O3) type. The plasma sprayed layers exhibit less corrosion resistance in vanadium containing atmospheres than the reference system ZrO2-8Y2O3. Envelopment of ZrO2/Y2O3 crystallites by silicates does not occur. The thermal shock resistance is worse compared to the ZrO2-8Y2O3 system despite a wide variety of tested parameters. Microsegmentation can not be achieved to a sufficient extent in order to make the ceramic strain tolerant. For these reasons the goals can not be met. ESA

N89-11748# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
RINSING WATER ANALYSIS OF HELICOPTER JET ENGINE COMPRESSORS
H. J. Kolkman 2 Jun. 1987 31 p

(NLR-TR-87074-U; B8817438; ETN-88-93382) Avail: NTIS HC A03/MF A01

The rinsing water of helicopter gas turbine compressors was investigated. The corrosive attack manifested by the presence of metal ions is related to: deposition during flight of the hygroscopic salts (NH4)2SO4 (originating from manure) and MgCl2 (from marine origin); acidification of the wet deposits during shutdown periods by the absorption of the air pollutants SO2 and NO2; and the rinsing frequency. Daily instead of weekly rinsing decreases, but does not eliminate corrosion. ESA

N89-11749# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

CORROSION IN GAS TURBINES

H. J. Kolkman 15 Sep. 1987 23 p In DUTCH; ENGLISH summary Presented at the Netherlands Corrosion Center's Working Group Meeting Corrosiedagen 1987, Utrecht, Netherlands, 10-12 Nov. 1987

(NLR-MP-87067-U; B8809142; ETN-88-93404) Avail: NTIS HC A03/MF A01

Electrochemical corrosion in gas turbine compressors; oxidation in turbines; and sulfidation in turbines are reviewed. Examples of failures by these processes are given. Countermeasures are discussed. ESA

N89-11750*# Flow Research, Inc., Kent, Wash.

AERODYNAMIC OPTIMIZATION BY SIMULTANEOUSLY UPDATING FLOW VARIABLES AND DESIGN PARAMETERS WITH APPLICATION TO ADVANCED PROPELLER DESIGNS

Magdi H. Rizk Jul. 1988 34 p

(Contract NAS3-24855)

(NASA-CR-182181; NAS 1.26:182181; FLOW-RR-447) Avail: NTIS HC A03/MF A01 CSCL 21E

A scheme is developed for solving constrained optimization problems in which the objective function and the constraint function are dependent on the solution of the nonlinear flow equations. The scheme updates the design parameter iterative solutions and the flow variable iterative solutions simultaneously. It is applied to an advanced propeller design problem with the Euler equations used as the flow governing equations. The scheme's accuracy, efficiency and sensitivity to the computational parameters are tested. Author

N89-11751*# Sverdrup Technology, Inc., Cleveland, Ohio.

A PRELIMINARY DESIGN STUDY OF SUPERSONIC THROUGH-FLOW FAN INLETS Final Report

Paul J. Barnhart Nov. 1988 12 p Previously announced in IAA as A88-53137

(Contract NAS3-24105)

(NASA-CR-182224; E-4490; NAS 1.26:182224) Avail: NTIS HC A03/MF A01 CSCL 21E

From Mach 3.20 cruise propulsion systems, preliminary design studies for two supersonic through-flow fan primary inlets and a single core inlet were undertaken. Method of characteristics and one dimensional performance techniques were applied to assess the potential improvements supersonic through-flow fan technology has over more conventional systems. A fixed geometry supersonic through-flow fan primary inlet was found to have better performance than a conventional inlet design on the basis of total pressure recovery, air flow, aerodynamic drag and size and weight. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N89-11752*# TAU Corp., Los Gatos, Calif.

AUTONOMOUS FLIGHT AND REMOTE SITE LANDING GUIDANCE RESEARCH FOR HELICOPTERS

R. V. Denton, N. J. Pecklesma, and F. W. Smith Aug. 1987 104 p

(Contract NAS2-12180)

(NASA-CR-177478; NAS 1.26:177478) Avail: NTIS HC A06/MF A01 CSCL 01C

Automated low-altitude flight and landing in remote areas within a civilian environment are investigated, where initial cost, ongoing maintenance costs, and system productivity are important considerations. An approach has been taken which has: (1) utilized those technologies developed for military applications which are directly transferable to a civilian mission; (2) exploited and developed technology areas where new methods or concepts are required; and (3) undertaken research with the potential to lead to innovative methods or concepts required to achieve a manual and fully automatic remote area low-altitude and landing capability. The project has resulted in a definition of system operational concept that includes a sensor subsystem, a sensor fusion/feature extraction capability, and a guidance and control law concept. These subsystem concepts have been developed to sufficient depth to enable further exploration within the NASA simulation environment, and to support programs leading to the flight test. Author

N89-11753*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

APPROXIMATION THEORY FOR LQG (LINEAR-QUADRATIC-GAUSSIAN) OPTIMAL CONTROL OF FLEXIBLE STRUCTURES Final Report

J. S. Gibson and A. Adamian (California Univ., Los Angeles.) Aug. 1988 121 p Submitted for publication

(Contracts NAS1-17070; NAS1-18107)

(NASA-CR-181705; ICASE-88-48; NAS 1.26:181705) Avail: NTIS HC A06/MF A01 CSCL 01C

An approximation theory is presented for the LQG (Linear-Quadratic-Gaussian) optimal control problem for flexible structures whose distributed models have bounded input and output operators. The main purpose of the theory is to guide the design of finite dimensional compensators that approximate closely the optimal compensator. The optimal LQG problem separates into an optimal linear-quadratic regulator problem and an optimal state estimation problem. The solution of the former problem lies in the solution to an infinite dimensional Riccati operator equation. The approximation scheme approximates the infinite dimensional LQG problem with a sequence of finite dimensional LQG problems defined for a sequence of finite dimensional, usually finite element or modal, approximations of the distributed model of the structure. Two Riccati matrix equations determine the solution to each approximating problem. The finite dimensional equations for numerical approximation are developed, including formulas for converting matrix control and estimator gains to their functional representation to allow comparison of gains based on different orders of approximation. Convergence of the approximating control and estimator gains and of the corresponding finite dimensional compensators is studied. Also, convergence and stability of the closed-loop systems produced with the finite dimensional compensators are discussed. The convergence theory is based on the convergence of the solutions of the finite dimensional Riccati equations to the solutions of the infinite dimensional Riccati equations. A numerical example with a flexible beam, a rotating rigid body, and a lumped mass is given. Author

N89-11754# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
FREQUENCY RESPONSE ANALYSIS OF HYBRID SYSTEMS
J. Schuring 27 Apr. 1987 78 p
(Contract NIVR-313.3-01902N)
(NLR-TR-87059-U; B8817852; ETN-88-93381) Avail: NTIS HC A05/MF A01

A dedicated frequency response analysis method was developed for hybrid digital control systems. For practical use of the method, it was expanded to an analysis method generally applicable to multi-input, multi-rate, linear time-invariant hybrid systems. Computer programs to apply the method were developed. The calculated frequency responses are presented graphically in Bode, Nyquist, and Nichols plots. An application of the method in aircraft control is elaborated. A tolerance to less conservative digital system design is clearly indicated. ESA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N89-11755# Aeronautical Research Labs., Melbourne (Australia).
DESIGN OF A NEW CONTRACTION FOR THE ARL LOW SPEED WIND TUNNEL
J. H. Watmuff Aug. 1986 39 p
(ARL-AERO-R-171; AR-004-496) Avail: NTIS HC A03/MF A01

A numerical method is developed for the solution of the Stokes' stream function. The method is applied to the existing Low Speed Wind Tunnel (LSWT) contraction shape. The calculated wall pressure coefficient distribution is compared to experimental measurements to test the approximation of axial symmetry made for the octagonal sections and for the effects of neglecting viscous forces. Reasonable agreement is obtained. The existing contraction is known to suffer from intermittent boundary layer separation near the entry caused by adverse pressure gradients. A new contraction shape is suggested that uses the contraction ratio of the existing LSWT so that the new design can be installed within the existing LSWT in the form of an inner skin. The new design, which is about 10 percent longer than the existing contraction, has an adverse pressure gradient near the inlet which is about 20 percent of that of the existing contraction while the adverse pressure gradient near the exit is around the same value. It is expected that the reduced adverse pressure gradient near the entry will be small enough to allow the inlet boundary layer to remain attached thus leading to a substantial improvement to the working section flow quality. Author

N89-11756*# Queensland Univ., St. Lucia (Australia). Dept. of M. E.
EXPANSION TUBE TEST TIME PREDICTIONS Final Report
Christopher M. Gourlay Sep. 1988 98 p
(Grant NAGw-674)
(NASA-CR-181722; Rept-8/88; NAS 1.26:181722) Avail: NTIS HC A05/MF A01 CSCL 14B

The interaction of an interface between two gases and strong expansion is investigated and the effect on flow in an expansion tube is examined. Two mechanisms for the unsteady Pitot-pressure fluctuations found in the test section of an expansion tube are proposed. The first mechanism depends on the Rayleigh-Taylor instability of the driver-test gas interface in the presence of a strong expansion. The second mechanism depends on the reflection of the strong expansion from the interface. Predictions compare favorably with experimental results. The theory is expected to be independent of the absolute values of the initial expansion tube filling pressures. Author

N89-11757# Marine Corps, Washington, D. C.
REQUIRED OPERATIONAL CAPABILITY (ROC) FOR A PORTABLE HELIPORT LIGHTING SET (PHLS)
19 Jan. 1988 12 p
(AD-A196372; USMC-ROC-LOG-216.1.2) Avail: NTIS HC A03/MF A01 CSCL 01E

In order to provide the unit commander with the greatest possible flexibility, the PHLS should consist of two components (an approach path indicator (API) and Landing Zone (LZ) marker lights) packaged as a set. The API will provide a tricolored glidepath to assist the pilot to a safe landing in a designated permissive LZ. The remotely controlled LZ markers will be used to mark the perimeter of the LZ and will have both an infrared (IR) and incandescent light capability. This would enable the markers to be used in conjunction with the API or separately to designate a non-permissive LZ. In the incandescent mode, the API and the LZ marker lights would be used to train pilots in night vertical assault operations and also would be used for missions flown into permissive LZ's. Pilots flying in a night vertical assault may use NVG's and employ terrain-following flight techniques. As elements of the flight cross the initial point (LP), the flight leader activates an IR LZ marker/identifier (a strobing marker light) using the aircraft's UHF radio transmitter. Once the LZ has been visually identified the pilot turn the marker off. It can then be turned back on by each successive wave, if required. GRA

N89-11758# European Space Agency, Paris (France).
THE ERICSSON-ESA NEAR-FIELD ANTENNA TEST FACILITY, MOLNDAL, SWEDEN
A. Molker (Ericsson Radio Systems A.B., Stockholm, Sweden) and Bruce Battrick, ed. May 1988 19 p Original contains color illustrations
(ESA-BR-38; ISSN-0250-1589; ETN-88-93160) Copyright Avail: NTIS HC A03/MF A01

The advantages and procedures of near field testing of spacecraft antennas are described, and a test facility is presented. The spherical method can be used for antennas up to 4 m in diameter with full coverage in the sidelobe region. The planar method can be used for antennas of up to 12 m x 5 m, depending on the sidelobe coverage requirement. The closer the antenna to the maximum dimension in one plane, the more limited is the region of correctly predicted sidelobes in that plane. An automatic network analyzer and an automatic theodolite system are stationed in the facility. The network analyzer allows very accurate determination of s-parameters via one- or two-port measurements. The theodolite system can be used for autocollimation measurements or contact-free coordinate measurements. With the former method the relative rotation between mirror-cube-equipped objects can be determined, e.g., the coordinates of the antenna under test can be referred to the measurement coordinates. The beam direction, determined in the measurement coordinates, can then be precisely referred back to the antenna coordinate system. With the latter method, the shape of antenna surfaces can be verified or referred to the measurement coordinate system. ESA

N89-11759# Technische Univ., Hanover (West Germany). Inst. fuer Verkehrswirtschaft.
AIRCRAFT FLEXIBLE PAVEMENT OVERLAY DESIGN AND EVOLUTION Ph.D. Thesis [ZUR BEMESSUNG UND BEWERTUNG VON FLUGPLATZBEFESTIGUNGEN MIT FLEXIBLEN DECKEN]
Juergen Schluesing 1988 158 p In GERMAN
(ETN-88-93230) Avail: NTIS HC A08/MF A01

Theoretical and empirical procedures for highway development and design are outlined. Design of flexible overlays is examined in consideration of single wheel path load effects. Dynamic behavior under horizontal and vertical load effects, climatic conditions and underground configurations are analyzed together with mechanical stresses in a computer program. ESA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N89-11760*# National Aeronautics and Space Administration, Washington, D.C.
TECHNOLOGY FOR FUTURE NASA MISSIONS: CIVIL SPACE TECHNOLOGY INITIATIVE (CSTI) AND PATHFINDER
Sep. 1988 550 p Conference held in Washington, D.C., 12-13 Sep. 1988; sponsored in part by NASA and AIAA
(NASA-CP-3016; NAS 1.55:3016) Avail: NTIS HC A23/MF A01 CSCL 22A

Information is presented in viewgraph form on a number of related topics. Information is given on orbit transfer vehicles, spacecraft instruments, spaceborne experiments, university/industry programs, spacecraft propulsion, life support systems, cryogenics, spacecraft power supplies, human factors engineering, spacecraft construction materials, aeroassist, aerobraking and aerothermodynamics. For individual titles, see N89-11761 through N89-11779.

N89-11761*# National Aeronautics and Space Administration, Washington, D.C.
CIVIL SPACE TECHNOLOGY INITIATIVE
Judith H. Ambrus *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 15-50 (For primary document see N89-11760 03-12)
Avail: NTIS HC A23/MF A01 CSCL 22A

Viewgraphs are presented on earth to orbit propulsion, booster technology, an aeroassist flight experiment, robotics, remote sensing of Earth, and autonomous systems. R.J.F.

N89-11762*# National Aeronautics and Space Administration, Washington, D.C.
PATHFINDER: OVERVIEW
Wayne R. Hudson, John Mankins, and John L. Anderson *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 51-56 (For primary document see N89-11760 03-12)
Avail: NTIS HC A23/MF A01 CSCL 22A

Viewgraphs are given that provide information on Pathfinder philosophy, status, technology needs, and program elements. R.J.F.

N89-11763*# National Aeronautics and Space Administration, Washington, D.C.
PATHFINDER: SURFACE EXPLORATION, IN-SPACE OPERATIONS AND SPACE TRANSFER
John Mankins *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 57-91 (For primary document see N89-11760 03-12)
Avail: NTIS HC A23/MF A01 CSCL 22A

Viewgraphs on the Pathfinder program are presented. Information is given on technology needs, a planetary rover, program management, an autonomous lander, mission applications, orbital assembly, cryogenics, space nuclear reactors, space manufacturing, optical communications, spacecraft propulsion, aerobraking, and orbital transfer vehicles. R.J.F.

N89-11764*# National Aeronautics and Space Administration, Washington, D.C.
PATHFINDER: HUMANS IN SPACE
John L. Anderson *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 93-106 (For primary document see N89-11760 03-12)
Avail: NTIS HC A23/MF A01 CSCL 22A

Viewgraphs are presented on the Pathfinder program. Information is given on human exploration of the solar system, technical requirements interfaces, program objectives, space suits, human performance, man-machine systems, space habitats, life support systems, and artificial gravity R.J.F.

N89-11765*# National Aeronautics and Space Administration, Washington, D.C.
SPACE RESEARCH AND TECHNOLOGY BASE OVERVIEW
Lana M. Couch *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 107-130 (For primary document see N89-11760 03-12)
Avail: NTIS HC A23/MF A01 CSCL 22A

Information in viewgraph form is given on aerothermodynamics, space energy conversion, spacecraft propulsion, spacecraft construction materials, spacecraft communications, spacecraft control, human factors engineering, and systems analysis. R.J.F.

N89-11766*# National Aeronautics and Space Administration, Washington, D.C.
IN-SPACE TECHNOLOGY EXPERIMENTS PROGRAM: InSTEP
Judith H. Ambrus *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 131-142 (For primary document see N89-11760 03-12)
Avail: NTIS HC A23/MF A01 CSCL 22A

Information is given in viewgraph form on space research and technology strategy, space shuttle experiments, experiments' planning, industry/university experiments, plasma arc welding in space, and international in-space experiments. R.J.F.

N89-11767*# National Aeronautics and Space Administration, Washington, D.C.
UNIVERSITY PROGRAM
Steven C. Hartman *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 143-155 (For primary document see N89-11760 03-12)
Avail: NTIS HC A23/MF A01 CSCL 22A

Information on university programs, program growth, and space research and technology strategy, are given in viewgraph form. R.J.F.

N89-11768*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE PROPULSION TECHNOLOGY AND CRYOGENIC FLUID DEPOT
Larry A. Diehl *In* NASA, Washington, Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 163-177 (For primary document see N89-11760 03-12)
Avail: NTIS HC A23/MF A01 CSCL 22A

Information on space propulsion and technology and the cryogenic fluid depot is given in viewgraph form. Information is given on orbit transfer, electric propulsion, spacecraft propulsion, and program objectives. Author

N89-11769*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NASA EARTH-TO-ORBIT PROPULSION R AND T
Robert J. Richmond *In* NASA, Washington, Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 179-192 (For primary document see N89-11760 03-12)
Avail: NTIS HC A23/MF A01 CSCL 22A

Information is given in viewgraph form on Earth-to-orbit propulsion research and technology, space transportation systems, spacecraft configurations, booster technology and hybrid propellant rocket engines. Author

N89-11770*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE POWER TECHNOLOGIES
Ronald J. Sovie *In* NASA, Washington, Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 193-218 (For primary document see N89-11760 03-12)
Avail: NTIS HC A23/MF A01 CSCL 22A

Information is given in viewgraph form on space power technologies. Energy conversion, the role of nuclear power in space, lunar and Mars bases, and the Pathfinder program are covered. R.J.F.

N89-11771*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PHYSICAL/CHEMICAL CLOSED-LOOP LIFE SUPPORT

James G. Lawless *In* NASA, Washington, Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 219-229 (For primary document see N89-11760 03-12)

Avail: NTIS HC A23/MF A01 CSCL 22A

Information on physical/chemical closed-loop life support systems are given in viewgraph form. Information is given on program objectives, the elements of a life support system, and Pathfinder program elements. R.J.F.

N89-11772*# National Aeronautics and Space Administration, Washington, D.C.

INFORMATION SCIENCES AND HUMAN FACTORS OVERVIEW

Lee B. Holcomb *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 231-245 (For primary document see N89-11760 03-12)

Avail: NTIS HC A23/MF A01 CSCL 22A

An overview of program objectives of the Information Sciences and Human Factors Division of NASA's Office of Aeronautics and Space Technology is given in viewgraph form. Information is given on the organizational structure, goals, the research and technology base, telerobotics, systems autonomy in space operations, space sensors, humans in space, space communications, space data systems, transportation vehicle guidance and control, spacecraft control, and major program directions in space. R.J.F.

N89-11773*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SYSTEMS AUTONOMY

Henry Lum, Jr. *In* NASA, Washington, Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 247-281 (For primary document see N89-11760 03-12)

Avail: NTIS HC A23/MF A01 CSCL 22A

Information on systems autonomy is given in viewgraph form. Information is given on space systems integration, intelligent autonomous systems, automated systems for in-flight mission operations, the Systems Autonomy Demonstration Project on the Space Station Thermal Control System, the architecture of an autonomous intelligent system, artificial intelligence research issues, machine learning, and real-time image processing. R.J.F.

N89-11774*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SENSORS RESEARCH AND TECHNOLOGY

James A. Cutts *In* NASA, Washington, Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 283-304 (For primary document see N89-11760 03-12)

Avail: NTIS HC A23/MF A01 CSCL 22A

Information on sensors research and technology is given in viewgraph form. Information is given on sensing techniques for space science, passive remote sensing techniques and applications, submillimeter coherent sensing, submillimeter mixers and local oscillator sources, non-coherent sensors, active remote sensing, solid state laser development, a low vibration cooler, separation of liquid helium and vapor phase in zero gravity, and future plans. R.J.F.

N89-11775*# National Aeronautics and Space Administration, Washington, D.C.

HUMANS IN SPACE

James P. Jenkins *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 305-314 (For primary document see N89-11760 03-12)

Avail: NTIS HC A23/MF A01 CSCL 22A

Information is given in viewgraph form on humans in space. Information is given on extravehicular activity/space suit project objectives and program schedule, and space human factors objectives and products. R.J.F.

N89-11776*# National Aeronautics and Space Administration, Washington, D.C.

MATERIALS AND STRUCTURES

Samuel L. Venneri *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 315-355 (For primary document see N89-11760 03-12)

Avail: NTIS HC A23/MF A01 CSCL 22A

Information on materials and structures for use in space is given in viewgraph form. Information is given on the Materials and Structures Division of NASA's Office of Aeronautics and Space Technology. The Division's space research and development budget is given. Further information is given on space materials and structures, space environmental effects, radiation effects, high temperature materials research, metal matrix composites, SiC fiber reinforced titanium alloys, structural dynamics, and control of flexible structures. R.J.F.

N89-11777*# National Aeronautics and Space Administration, Washington, D.C.

FLIGHT PROJECTS OVERVIEW

Jack Levine *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 357-377 (For primary document see N89-11760 03-12)

Avail: NTIS HC A23/MF A01 CSCL 22A

Information is given in viewgraph form on the activities of the Flight Projects Division of NASA's Office of Aeronautics and Space Technology. Information is given on space research and technology strategy, current space flight experiments, the Long Duration Exposure Facility, the Orbiter Experiment Program, the Lidar In-Space Technology Experiment, the Ion Auxiliary Propulsion System, the Arcjet Flight Experiment, the Telerobotic Intelligent Interface Flight Experiment, the Cryogenic Fluid Management Flight Experiment, the Industry/University In-Space Flight Experiments, and the Aeroassist Flight Experiment. R.J.F.

N89-11778*# National Aeronautics and Space Administration, Washington, D.C.

IN-REACH AND OUT-REACH PROGRAMS

Jon S. Pyle *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 379-397 (For primary document see N89-11760 03-12)

Avail: NTIS HC A23/MF A01 CSCL 22A

Information is given in viewgraph form on in-reach and out-reach programs in in-space technology experiments. Information is given on thermal energy storage materials technology, industry/university in-space technology experiments, heat pipe performance, working fluid behavior, a tank pressure control experiment, spacecraft glow, the Mid-Deck Zero-Gravity Dynamics Experiment, and emulsion chamber technology. R.J.F.

N89-11779*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AEROASSIST FLIGHT EXPERIMENT (AFE)

Paul M. Siemers, III *In* NASA, Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder Sep. 1988 p 399-411 (For primary document see N89-11760 03-12)

Avail: NTIS HC A23/MF A01 CSCL 22A

Information is given in viewgraph form on the Aeroassist Flight Experiment (AFE), an experiment with the objective of investigating critical vehicle design and environmental technologies applicable to the design of aeroassisted space transfer vehicles. Information is given on design, simulation, flight regime, mission requirements and objectives, instrumentation, and the project schedule. R.J.F.

N89-11780*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GROWTH REQUIREMENTS FOR MULTIDISCIPLINE RESEARCH AND DEVELOPMENT ON THE EVOLUTIONARY SPACE STATION
Barry Meredith, Peter Ahlf, Rudy Saucillo, and David Eakman (McDonnell-Douglas Astronautics Co., Rockville, Md.) Sep. 1988 146 p
(NASA-TM-101497; NAS 1.15:101497) Avail: NTIS HC A07/MF A01 CSCL 22A

The NASA Space Station Freedom is being designed to facilitate on-orbit evolution and growth to accommodate changing user needs and future options for U.S. space exploration. In support of the Space Station Freedom Program Preliminary Requirements Review, The Langley Space Station Office has identified a set of resource requirements for Station growth which is deemed adequate for the various evolution options. As part of that effort, analysis was performed to scope requirements for Space Station as an expanding, multidiscipline facility for scientific research, technology development and commercial production. This report describes the assumptions, approach and results of the study. Author

N89-11781# Kayser Threde G.m.b.H., Munich (West Germany).
MEDEA MISSION PLANNING (SPACELAB MISSION D1) Final Report, May 1986
Georg Kampfer Dec. 1987 77 p In GERMAN; ENGLISH summary
(Contract BMFT-01-TW-024-AK/RT)
(D1-MD-RP-022-KT; ETN-88-93201) Avail: NTIS HC A05/MF A01

The payload element MEDEA was developed and built as a double rack for materials research in Spacelab mission D1. The experimental facility includes a high precision thermostat with associated control-regulation equipment and vacuum pumps. Improvements for facility integration are suggested for the initial and operational phases, and solutions are proposed for misson D2. ESA

N89-11782# Swedish Inst. of Space Physics, Kiruna.
[ACTIVITIES REPORT IN SPACE PHYSICS] Annual Report, 1987
Lars Eliasson and Ingrid Sandahl 1988 70 p Original contains color illustrations
(ISSN-0284-169X; ETN-88-93540) Avail: NTIS HC A04/MF A01

In situ hot plasma investigations; sounding rocket experiments; EISCAT; radio remote sensing; optical studies of auroral dynamics; wave propagation; wave-particle interactions; magnetospheric storms; ionospheric modification; and the Swedish Viking satellite are discussed. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N89-11783# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.
WITH A SIMPLE CALCULATION MODEL IT IS POSSIBLE TO ACCURATELY DETERMINE THE GEOGRAPHICAL COORDINATES OF A NOAA SATELLITE IMAGE ELEMENT [MIT EINFACHEN RECHENMODELLEN ERREICHBARE GENAUIGKEIT DER GEOGRAPHISCHEN ZUORDNUNG EINES BILDELEMENTES DER NOAA-SATELLITEN]
J. Straka and H. Grassl 1988 46 p In GERMAN; ENGLISH summary
(GKSS-88/E/13; ISSN-0344-9629; ETN-88-93199) Copyright Avail: NTIS HC A03/MF A01

A program giving at any time the corresponding position of the nadir point of a satellite was developed especially for the NOAA-TIROS/N-series. Thus the perturbations of the satellite orbit due to the anisotropy of the gravitational potential of the Earth being approximated as a rotational ellipsoid as well as those due to the gravitation of the Sun and Moon are taken into account. For 33 different times between Jan. 1, 1984 and June 3, 1985 with the corresponding orbital elements of the NOAA-7 satellite, tests show that longitudinal terms (i.e., tesseral and sectorial hamonics) in the anisotropy of the potential of the Earth have to be included if nadir position errors smaller than 1 km (pixel size) are needed. Using the mentioned data set alone, the synodic periods of NOAA-7 at the 33 instants of osculation (equator-crossing times) were calculated, to determine by means of interpolation the time instants of all the equator crossings occurring between two adjoining osculations. Knowing all the equator crossings, overpasses over a given latitude between two equator crossings are calculated. ESA

N89-11784# Royal Aerospace Establishment, Farnborough (England).
EXPLICIT FORMS OF SOME FUNCTIONS ARISING IN THE ANALYSIS OF RESONANT SATELLITE ORBITS
R. H. Gooding and D. G. King-Hele May 1988 34 p
(RAE-TR-88035; RAE-Space-671; BR107048; ETN-88-93560) Copyright Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

The analysis of resonant satellite orbits has been pursued for 18 years, and has led to the most accurate values available for lumped geopotential harmonics of the relevant orders. The basic theory for the resonance effects was developed in the 1960s, but the detailed application of the technique calls for a systematic notation and for the evaluation of two subsidiary functions, namely F, a function of the orbital inclination, and G, a function of the eccentricity. The present paper sets out explicitly the variations in inclination and eccentricity produced by relevant harmonics at the most common resonances (15:1, 14:1, 16:1, 29:2 and 31:2), using the notation that has become standardized in recent years. The paper also gives appropriate expressions for calculating F and G, with a new FORTRAN program GQUAD for evaluating G. ESA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N89-11785 Georgia Inst. of Tech., Atlanta.
TRANSIENT PHENOMENA IN PLASMA ARMATURES OF ELECTROMAGNETIC PROJECTILE ACCELERATORS Ph.D. Thesis
Glenn Evan Rolader 1987 203 p
Avail: Univ. Microfilms Order No. DA8803711

Three separate mathematical models are developed in order to examine transient phenomena in railgun plasma armatures. The first model consists of equations for the conservation of mass, momentum, and magnetic induction for an isothermal plasma. Upon departure from equilibrium, the arc length and other arc parameters exhibit damped oscillations about their corresponding equilibrium values. Multiple simulations are performed to investigate characteristic relaxation and oscillation periods. It is found that the period of oscillation for each perturbation is, for early times, approximately equal to 3 l(eq)/a(o), where l(eq) is the equilibrium armature length, and a sub o is the acoustic propagation velocity in the plasma. The second model relaxes the isothermal assumption and allows for variations in the temperature, both spatially and temporally. An applicable energy equation is formulated, and the continuity, momentum, and magnetic induction equations are modified to account for variations in the temperature. This formulation is used to investigate the thermal effects on the transient dynamics of the plasma. The final model not only accounts for variable temperature, but includes the effect of finite-height rails and tranverse heat loss. Dissert. Abstr.

N89-11786*# Lunar and Planetary Inst., Houston, Tex.
ADVANCED ANALYTICAL FACILITIES REPORT OF THE PLANETARY MATERIALS AND GEOCHEMISTRY WORKING GROUP
9 Nov. 1988 45 p
(NASA-CR-183338; NAS 1.26:183338; LPI-TRN-88-11) Avail: NTIS HC A03/MF A01 CSCL 14B

The aircraft industry is concerned with the increase of drag on planes due to the sticking of insects on critical airfoil areas. The effects of surface energy and elasticity on the number of insects sticking onto the polymer coatings on a modified aircraft wing were investigated and the mechanism by which insects stick onto surfaces during a high velocity impact was determined. Analyses including scanning electron microscopy, electron spectroscopy for chemical analysis and contact angle measurements of uncoated and polymer coated aluminum surfaces were performed. An air gun was designed to accelerate insects to high speeds and impact them onto modified wing surfaces in a lab environment. A direct relation between the number of insects sticking on a sample and its surface energy was obtained. Author

N89-11787# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ANALYSIS OF AN INVERSE RAILGUN WITH A RAILGUN LOAD
John D. Powell and Keith A. Jamison Jul. 1988 45 p
(AD-A196619; BRL-TR-2926) Avail: NTIS HC A03/MF A01 CSCL 20C

A model is presented to analyze theoretically an inverse railgun used as a power supply for a railgun. The governing equations are developed and it is shown that they possess an exact analytic solution in the limit that resistive effects can be neglected. These limiting-case solutions are used to study qualitatively the behavior of the inverse railgun in this configuration. More general numerical solutions, which account approximately for resistive effects, are then undertaken and discussed in some detail. Emphasis is placed on determining design parameters which optimize energy transfer between the two devices. The analysis suggests that the railgun, unlike most other loads, can be powered effectively with an inverse railgun. GRA

N89-11788# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
SATELLITE SIMULATOR FOR THE LWS-ISO EXPERIMENT [SIMULATORE DI SATELLITE PER L'ESPERIMENTO LWS-150]
P. Cerulli-Irelli Aug. 1988 33 p In ITALIAN
(IFSI-88-11; ETN-88-93478) Avail: NTIS HC A03/MF A01

A simulator to furnish, during the test period, the data and telecommand signals normally generated by the satellite onboard data handling system was built. The implementation was done with an IBM-XT microcomputer, modified with two especially designed extension cards. A menu system with five options is included. The listing of the C language program is presented. ESA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

No abstracts in this category.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N89-11789# European Space Agency, Paris (France).
PREPARING FOR HERMES: SPACE TRANSPORTATION SYSTEMS; LONG TERM PREPARATORY PROGRAM. RESULTS OF TECHNOLOGICAL STUDIES Interim Report, 1988
Norman Longdon, ed. Aug. 1988 68 p Original contains color illustrations
(ESA-SP-1096; ISSN-0379-6566; ETN-88-93159) Copyright Avail: NTIS HC A04/MF A01

Hermes operational and spacecraft technology studies are summarized. Requirements and concepts for manned rendezvous and docking; a docking adaptor mechanism; transfer airlock requirements; control of docked Hermes-Columbus elements; extravehicular activities; general requirements, human factors engineering, and life support systems; protection against radiation in space; and manipulator adaptation were studied. High performance composite structures; propulsion systems for reusable man-rated spacecraft; signal compression; optical bus; communication processors; antenna pattern prediction software; common power technology; fuel cells for space use; environmental control and life support technology; and subsonic wind tunnel tests are discussed. ESA

N89-11790*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ICE/FROST/DEBRIS ASSESSMENT FOR SPACE SHUTTLE MISSION STS-26R
Charles G. Stevenson, Gregory N. Katnik, and Scott A. Higginbotham 7 Nov. 1988 231 p
(NASA-TM-100987; NAS 1.15:100987) Avail: NTIS HC A11/MF A01 CSCL 22B

An Ice/Frost/Debris Assessment was conducted for Space Shuttle Mission STS-26R. Debris inspections of the flight elements and launch pad are performed before and after launch. Ice/Frost conditions are assessed by use of computer programs, nomographs, and infrared scanner data during cryogenic loading of the vehicle followed by an on-pad visual inspection. High speed photography is viewed after launch to identify ice/debris sources and evaluate potential vehicle damage. The Ice/Frost/Debris conditions of Mission 26R and their effect on the Space Shuttle Program is documented. Author

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N89-11791*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN APPLICATION OF HIGH AUTHORITY/LOW AUTHORITY CONTROL AND POSITIVITY

S. M. Seltzer, D. Irwin, D. Tollison (Control Dynamics Co., Huntsville, Ala.), and H. B. Waites Aug. 1988 15 p

(NASA-TM-100338; NAS 1.15:100338) Avail: NTIS HC A03/MF A01 CSCL 22B

Control Dynamics Company (CDy), in conjunction with NASA Marshall Space Flight Center (MSFC), has supported the U.S. Air Force Wright Aeronautical Laboratory (AFWAL) in conducting an investigation of the implementation of several DOD controls techniques. These techniques are to provide vibration suppression and precise attitude control for flexible space structures. AFWAL issued a contract to Control Dynamics to perform this work under the Active Control Technique Evaluation for Spacecraft (ACES) Program. The High Authority Control/Low Authority Control (HAC/LAC) and Positivity controls techniques, which were cultivated under the DARPA Active Control of Space Structures (ACOSS) Program, were applied to a structural model of the NASA/MSFC Ground Test Facility ACES configuration. The control systems design were accomplished and linear post-analyses of the closed-loop systems are provided. The control system designs take into account effects of sampling and delay in the control computer. Nonlinear simulation runs were used to verify the control system designs and implementations in the facility control computers. Finally, test results are given to verify operations of the control systems in the test facility. Author

N89-11792*# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.

SPACE LAB SYSTEM ANALYSIS Interim Final Report, Oct. 1987 - Oct. 1988

T. B. Rives and F. M. Ingels 1988 222 p

(Contract NAS8-36717)

(NASA-CR-183507; NAS 1.26:183507; MSU-EE-FIN-9-88) Avail: NTIS HC A10/MF A01 CSCL 22B

An analysis of the Automated Booster Assembly Checkout System (ABACS) has been conducted. A computer simulation of the ETHERNET LAN has been written. The simulation allows one to investigate different structures of the ABACS system. The simulation code is in PASCAL and is VAX compatible. Author

N89-11793*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.

CONTROL OF FLEXIBLE STRUCTURES-2 (COFS-2) FLIGHT CONTROL, STRUCTURE AND GIMBAL SYSTEM INTERACTION STUDY Final Report

Stanley Fay, Stephen Gates, Timothy Henderson, Lester Sackett, Kim Kirchwey, Isaac Stoddard, and Joel Storch Sep. 1988 205 p

(Contract NAS9-17560)

(NASA-CR-172095; R-2088; NAS 1.26:172095) Avail: NTIS HC A10/MF A01 CSCL 22B

The second Control Of Flexible Structures Flight Experiment (COFS-2) includes a long mast as in the first flight experiment, but with the Langley 15-m hoop column antenna attached via a gimbal system to the top of the mast. The mast is to be mounted in the Space Shuttle cargo bay. The servo-driven gimbal system could be used to point the antenna relative to the mast. The dynamic interaction of the Shuttle Orbiter/COFS-2 system with the Orbiter on-orbit Flight Control System (FCS) and the gimbal pointing control system has been studied using analysis and simulation. The Orbiter pointing requirements have been assessed for their impact on allowable free drift time for COFS experiments. Three fixed antenna configurations were investigated. Also simulated was Orbiter attitude control behavior with active vernier jets during antenna slewing. The effect of experiment mast dampers was included. Control system stability and performance and loads on various portions of the COFS-2 structure were investigated. The study indicates possible undesirable interaction between the Orbiter FCS and the flexible, articulated COFS-2 mast/antenna system, even when restricted to vernier reaction jets. Author

N89-11794# CSA Engineering, Inc., Palo Alto, Calif.

SCALING OF LARGE SPACE STRUCTURE JOINTS Final Report, Jul. 1987 - Feb. 1988

David A. Kienholz Jun. 1988 30 p

(Contract F33615-87-C-3239)

(AD-A197027; CSA-880204; AFWAL-TR-88-3047) Avail: NTIS HC A03/MF A01 CSCL 22E

Large orbiting spacecraft will often use trusses as primary, load-carrying structure. Favorable strength/weight and stiffness/weight ratios as well as compact stowage make trusses a natural candidate for erectable space structures. However the sheer size of proposed spacecraft raises important questions with respect to verification of their predicted dynamic properties. Assembled orbiting structures will be, in many cases, much too large for ground vibration testing. Some are not even capable of supporting their own weight in the earth's gravity. Various truss structures currently proposed for on-orbit assembly are too large to be tested on the ground. This has led to renewed interest in scale models for verification of predicted structural dynamic properties. However, a realistic scale model truss requires joints whose stiffness and damping properties are in-scale with those of the full-size counterpart. The primary conclusion is that accurate scale modeling of erectable trusses is quite feasible. GRA

N89-11795# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

AESOD: STUDY ON ATTITUDE AND ORBIT CONTROL SYSTEM (AOCS) SOFTWARE DESIGN

B. Gerlich and U. Schwan Paris, France ESA 7 Dec. 1987 77 p Prepared in cooperation with CRISA, Madrid, Spain

(Contract ESTEC-6534/85-NL-AN(SC))

(AESOD-DS-RE-0002; ESA-CR(P)-2575; ETN-88-93163)

Copyright Avail: NTIS HC A05/MF A01

Standard software was defined, established, and tested for AOCS specific applications, and other applications, e.g., experiments. The software, called AOCS Executive (A/X), is reusable, adaptable, and extendable. Dependencies on environment were isolated as far as possible to allow use of a processor other than INTEL 8086, use of another operating system than INTEL IRMX 86, and use of other hardware equipment for (sub-) system communication than the modular attitude control system and onboard data handling bus. The application layer, which is the uppermost layer, is, in principle, not part of A/X, but usually uses A/X routines. The A/X library consists of routines which are application specific but reusable. The Common A/X layer, which forms the basic part of the A/X handles application, mode, and configuration management, and management of peripherals. In the basic A/X layer, time, memory, and task management, and the interface to the operating system are found. The A/X is implemented in C language, using Ada design principles. The AOCS test environment consists of an attitude control electronics based on a 16 bit INTEL processor 8086 and the coprocessors 8087 and 8089 for numeric and for data transmission tasks; and an INTEL Series 4 development system for test support. The development environment includes a micro VAX and IBM PC's, with associated hardware. The real-time related routines were tested on the Target Hardware Environment, only, while all other routines were pretested on the development environment using emulation routines for missing hardware, if necessary. ESA

N89-11796# Interuniversity Micro-Electronics Center, Leuven (Belgium).
USE OF NONVOLATILE SEMICONDUCTOR CIRCUITS IN AUTONOMOUS SPACECRAFT CONTROL Final Report
H. E. Maes, J. Witters, and E. Schenkelaers Paris, France ESA 1988 46 p
(Contract ESTEC-6918/86-NL-IW(SC))
(ESA-CR(P)-2639; ETN-88-93170) Avail: NTIS HC A03/MF A01

The suitability of commercially available nonvolatile memory parts for very specific applications in spacecraft was studied. Potential products were identified and concrete proposals for their applications were developed. Design of a general purpose computing system with the ability of store data in nonvolatile RAM at power failure is shown. ESA

N89-11797# British Aerospace Public Ltd. Co., Stevenage (England). Space and Communications Div.
MODULE DESIGN FOR IN-ORBIT SERVICING. VOLUME 1: EXECUTIVE SUMMARY Final Report
M. Hempsell, comp. Paris, France ESA Apr. 1986 46 p
(Contract ESTEC-1638/84-NL-PB)
(BAe-TP-8253; ESA-CR(P)-2641; ETN-88-93171) Copyright Avail: NTIS HC A03/MF A01

Identification of design concepts for a spacecraft and orbit replaceable units (ORUs) which are compatible with in-orbit servicing (IOS); identification of ORU interface restraints with respect to the satellite and a service manipulator; identification of operational, reliability, and safety constraints; recommendation of a standardized ORU concept to be compatible for all satellite systems; and recommendation of a technology program for the development of ORUs suitable for an operational IOS are summarized. ESA

N89-11798# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Communication and Propulsion Systems Div.
STUDY ON REENTRY GUIDANCE AND CONTROL. VOLUME 1: EXECUTIVE SUMMARY Final Report
H. Grallert, ed. Paris, France ESA 20 Apr. 1988 38 p
(Contract ESA-6718/86-NL-AN)
(ESA-CR(P)-2652-Vol-1; ETN-88-93248) Copyright Avail: NTIS HC A03/MF A01

Simulation capabilities, using industrial software, for reentry problems of winged vehicles and upper stages were developed. Vehicle definition and orbital constraints; reentry trajectory simulation; and flight control system and guidance concepts are summarized. ESA

N89-11799# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Communication and Propulsion Systems Div.
STUDY ON REENTRY GUIDANCE AND CONTROL. VOLUME 2: VEHICLE DEFINITION AND ORBITAL CONSTRAINTS Final Report
H. Grallert, ed. Paris, France ESA 20 Apr. 1988 149 p
(Contract ESA-6718/86-NL-AN)
(ESA-CR(P)-2652-Vol-2; ETN-88-93249) Copyright Avail: NTIS HC A07/MF A01

In the scope of a reentry guidance and control study, the reference vehicle was derived from the HORUS shuttle configuration. All necessary geometric and aerodynamic parameters are clearly identified for trajectory calculations and further heat load assessments. Related to these considerations the orbit and trajectory constraints are described. ESA

N89-11800# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Communication and Propulsion Systems Div.
STUDY ON REENTRY GUIDANCE AND CONTROL. VOLUME 3: REENTRY TRAJECTORY SIMULATION Final Report
H. Grallert, ed. Paris, France ESA 20 Apr. 1988 502 p
(Contract ESA-6718/86-NL-AN)
(ESA-CR(P)-2652-Vol-3; ETN-88-93250) Copyright Avail: NTIS HC A22/MF A01

The parameter defining the Keplerian phase of the reentry mission of a winged vehicle descending from circular low Earth orbit into atmosphere at 120 km altitude was studied. Entry parameter variations with deorbiting maneuver characteristics, and their sensitivities were analyzed. ESA

N89-11801# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Communication and Propulsion Systems Div.
STUDY ON REENTRY GUIDANCE AND CONTROL. VOLUME 4: FLIGHT CONTROL SYSTEM (FCS) AND GUIDANCE CONCEPTS Final Report
H. Grallert, ed. Paris, France ESA 20 Apr. 1988 235 p
(Contract ESA-6718/86-NL-AN)
(ESA-CR(P)-2652-Vol-4; ETN-88-93325) Copyright Avail: NTIS HC A11/MF A01

Simulation capabilities, using industrial software, for reentry problems of winged vehicles and upper stages were developed. The dynamical model and the equations of motion for controller design are given. A controller is presented and tested by simulation in the time domain. Terminal area guidance strategies are assessed. ESA

N89-11802*# Arinc Research Corp., Annapolis, Md.
SPACE STATION ELECTRICAL POWER SYSTEM AVAILABILITY STUDY Final Contractor Report
Scott R. Turnquist and Mark A. Twombly Nov. 1988 192 p
(NASA Order C-31003-J)
(NASA-CR-182198; NAS 1.26:182198; ARINC-RP-5149-11-01-4744) Avail: NTIS HC A09/MF A01 CSCL 22B

ARINC Research Corporation performed a preliminary reliability, and maintainability (RAM) anlaysis of the NASA space station Electric Power Station (EPS). The analysis was performed using the ARINC Research developed UNIRAM RAM assessment methodology and software program. The analysis was performed in two phases: EPS modeling and EPS RAM assessment. The EPS was modeled in four parts: the insolar power generation system, the eclipse power generation system, the power management and distribution system (both ring and radial power distribution control unit (PDCU) architectures), and the power distribution to the inner keel PDCUs. The EPS RAM assessment was conducted in five steps: the use of UNIRAM to perform baseline EPS model analyses and to determine the orbital replacement unit (ORU) criticalities; the determination of EPS sensitivity to on-orbit spared of ORUs and the provision of an indication of which ORUs may need to be spared on-orbit; the determination of EPS sensitivity to changes in ORU reliability; the determination of the expected annual number of ORU failures; and the integration of the power generator system model results with the distribution system model results to assess the full EPS. Conclusions were drawn and recommendations were made. Author

N89-11803*# Textron Bell Aerospace Co., Buffalo, N. Y.
SPACE STATION AUXILIARY THRUST CHAMBER TECHNOLOGY Final Report
J. M. Senneff Feb. 1987 44 p
(Contract NAS3-24883)
(NASA-CR-179650; NAS 1.26:179650; Bell-Rept-8911-950003) Avail: NTIS HC A03/MF A01 CSCL 20H

A program to design, fabricate, and test a 50 lb sub f (222 N) thruster was undertaken to demonstrate the applicability of the reverse flow concept as an item of auxillary propulsion for the Space Station. The thruster was to operate at a mixture ratio (O/F) of 4, be capable of operating for 2 million lb sub f-seconds (8.896 million N-seconds) impulse with a chamber pressure of 75 psia (52N/sq cm) and a nozzle area ratio of 40. A successful demonstration of an (0/F) of 4 thruster, was followed by the design objective of operating at (O/F) of 8. The demonstration of this thruster resulted in the order of and additional (O/F) of 8 thruster chamber under the present NAS 3-24883 contract. The effort to fabricate and test the second (0/F) of 8 thruster is documented. Author

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N89-11804*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HARDWARE DEVELOPMENT FOR THE SURFACE TENSION DRIVEN CONVECTION EXPERIMENT ABOARD THE USML-1 SPACELAB MISSION
A. D. Pline, T. P. Jacobson, J. S. Wanhainen, and D. A. Petrarca [1988] 12 p Prepared for presentation at the 27th Aerospace Sciences Meeting, Reno, Nev., 9-12 Jan. 1989; sponsored in part by AIAA
(NASA-TM-101404; E-4488; NAS 1.15:101404; AIAA-89-0406)
Avail: NTIS HC A03/MF A01 CSCL 22A

The Surface Tension Driven Convection Experiment is a Space Transportation System flight experiment to study both transient and steady thermocapillary fluid flows aboard the USML-1 Spacelab mission planned for March 1992. Hardware is under development to establish the experimental conditions and perform the specified measurements, for both ground based research and the flight experiment in a Spacelab single rack. Major development areas include an infrared thermal imaging system for surface temperature measurement, a CO2 laser and control system for surface heating, and for flow visualization, a He-Ne laser and optical system in conjunction with an intensified video camera. For ground based work the components of each system were purchased or designed, and tested individually. The three systems will be interfaced with the balance of the experimental hardware and will constitute a working engineering model. A description of the three systems and examples of the component performance is given along with the plans for the development of flight hardware. Author

N89-12101# Geological Survey, Dover, Del.
SIMULATION OF A SPINNING SPACECRAFT MAGNETOMETER
Z. Wang and J. C. Cain *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 47-51 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 22B

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N89-11805*# Aerojet TechSystems Co., Sacramento, Calif.
INTEGRATED CONTROL AND HEALTH MANAGEMENT. ORBIT TRANSFER ROCKET ENGINE TECHNOLOGY PROGRAM Final Report
Wilfried A. Holzmann and Warren R. Hayden Oct. 1988 139 p
(Contract NAS3-23772)
(NASA-CR-182122; NAS 1.26:182122; ATC-2459-42-1) Avail: NTIS HC A07/MF A01 CSCL 21H

To insure controllability of the baseline design for a 7500 pound thrust, 10:1 throttleable, dual expanded cycle, Hydrogen-Oxygen, orbit transfer rocket engine, an Integrated Controls and Health Monitoring concept was developed. This included: (1) Dynamic engine simulations using a TUTSIM derived computer code; (2) analysis of various control methods; (3) Failure Modes Analysis to identify critical sensors; (4) Survey of applicable sensors technology; and, (5) Study of Health Monitoring philosophies. The engine design was found to be controllable over the full throttling range by using 13 valves, including an oxygen turbine bypass valve to control mixture ratio, and a hydrogen turbine bypass valve, used in conjunction with the oxygen bypass to control thrust. Classic feedback control methods are proposed along with specific requirements for valves, sensors, and the controller. Expanding on the control system, a Health Monitoring system is proposed including suggested computing methods and the following recommended sensors: (1) Fiber optic and silicon bearing deflectometers; (2) Capacitive shaft displacement sensors; and (3) Hot spot thermocouple arrays. Further work is needed to refine and verify the dynamic simulations and control algorithms, to advance sensor capabilities, and to develop the Health Monitoring computational methods. Author

N89-11806# Societe d'Etudes et de Services pour Souffleries et Installations Aerothermodynamiques, Paris (France).
ROCKET EXHAUST PLUMES ISSUED FROM AXISYMMETRICAL AND SCARFED NOZZLES, EXECUTIVE SUMMARY
J. Allegre, J. C. Lengrand, and M. Raffin Paris, France ESA Mar. 1988 51 p
(Contract ESTEC-6830/86-NL-PH(SC))
(SESSIA-88-757; ESA-CR(P)-2656; ETN-88-93253) Avail: NTIS HC A04/MF A01

Body impingement situations, where plumes from one spacecraft impinge on another, were examined in relation to Columbus and Hermes. Plume models relative to axisymmetrical configurations were reviewed. Model INTERJET was applied to the MBB 400 N bipropellant engine, yielding results consistent with those of another model. The choice of the data to be introduced as input when calculating a real thruster was examined. A computer code SCARFN was developed, based on a model for calculating the performance of a scarfed nozzle, together with a model for the description of plumes from scarfed nozzles. This model was applied to the same thruster, assumed to be equipped with a scarfed nozzle. A simplified model for nozzle performance was examined and the conditions for its validity were pointed out. An experimental program tested the validity of the models. Density and Pitot pressure distributions in plumes issued from three nozzles (one axisymmetrical) were obtained. Discrepancies between experimental and predicted flowfields are observed, essentially in the case of the nozzles with a high exit Mach number. Potential explanations lie in the experimental procedure and in the model. ESA

N89-11807*# Arizona State Univ., Tempe. Dept. of Electronics and Computer Technology.
IDENTIFICATION OF HIGH PERFORMANCE AND COMPONENT TECHNOLOGY FOR SPACE ELECTRICAL POWER SYSTEMS FOR USE BEYOND THE YEAR 2000 Final Technical Report, 16 May 1986 - 15 Dec. 1988
James E. Maisel 5 Dec. 1988 227 p
(Grant NAG3-714)
(NASA-CR-183003; NAS 1.26:183003) Avail: NTIS HC A11/MF A01 CSCL 10B

Addressed are some of the space electrical power system technologies that should be developed for the U.S. space program to remain competitive in the 21st century. A brief historical overview of some U.S. manned/unmanned spacecraft power systems is discussed to establish the fact that electrical systems are and will continue to become more sophisticated as the power levels appoach those on the ground. Adaptive/Expert power systems that can function in an extraterrestrial environment will be required to take an appropriate action during electrical faults so that the impact is minimal. Manhours can be reduced significantly by relinquishing tedious routine system component maintenance to the adaptive/expert system. By cataloging component signatures over time this system can set a flag for a premature component failure and thus possibly avoid a major fault. High frequency operation is important if the electrical power system mass is to be cut significantly. High power semiconductor or vacuum switching components will be required to meet future power demands. System mass tradeoffs have been investigated in terms of operating at high temperature, efficiency, voltage regulation, and system reliability. High temperature semiconductors will be required. Silicon carbide materials will operate at a temperature around 1000 K and the diamond material up to 1300 K. The driver for elevated temperature operation is that radiator mass is reduced significantly because of inverse temperature to the fourth power. Author

N89-11808*# Colorado State Univ., Fort Collins. Dept. of Physics.
CLOSED-DRIFT THRUSTER INVESTIGATIONS
Raymond S. Robinson, Terry D. Schemmel, and Michael J. Patterson Jun. 1986 50 p
(Grant NsG-3011)
(NASA-CR-179497; NAS 1.26:179497) Avail: NTIS HC A03/MF A01 CSCL 21H

Recent data obtained from a second generation closed-drift thruster design, employing Hall current acceleration is outlined. This type device is emphasized for electric propulsion for geocentric mission applications. Because geocentric mission profiles are best achieved with a specific impulse range of 1000 to 2000 s, closed-drift thrusters are well suited for this application, permitting time payload compromises intermediate of those possible with either electrothermal or electrostatic devices. A discussion is presented of the potential advantages of using a 1000 to 2000 s device for one way orbit raising of nonpower payloads. Because closed-drift thruster operation is not space charge limited, and requires only one power circuit for steady state operation, their application is technically advantageous. Beam, plasma and thrust characteristics are detailed for a range of operating conditions. Author

N89-11809*# Wisconsin Univ., Madison.
STUDY OF THE GENERATOR/MOTOR OPERATION OF INDUCTION MACHINES IN A HIGH FREQUENCY LINK SPACE POWER SYSTEM Final Report
Thomas A. Lipo and Pradeep K. Sood Mar. 1987 185 p
(Grant NAG3-631)
(NASA-CR-179600; NAS 1.26:179600) Avail: NTIS HC A09/MF A01 CSCL 10B

Static power conversion systems have traditionally utilized dc current or voltage source links for converting power from one ac or dc form to another since it readily achieves the temporary energy storage required to decouple the input from the output. Such links, however, result in bulky dc capacitors and/or inductors and lead to relatively high losses in the converters due to stresses on the semiconductor switches. The feasibility of utilizing a high frequency sinusoidal voltage link to accomplish the energy storage and decoupling function is examined. In particular, a type of resonant six pulse bridge interface converter is proposed which utilizes zero voltage switching principles to minimize switching losses and uses an easy to implement technique for pulse density modulation to control the amplitude, frequency, and the waveshape of the synthesized low frequency voltage or current. Adaptation of the proposed topology for power conversion to single-phase ac and dc voltage or current outputs is shown to be straight forward. The feasibility of the proposed power circuit and control technique for both active and passive loads are verified by means of simulation and experiment. Author

23 CHEMISTRY AND MATERIALS (GENERAL)

N89-11810# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: MATERIALS SCIENCE
25 Apr. 1988 46 p Transl. into ENGLISH from various Russian articles
(JPRS-UMS-88-008) Avail: NTIS HC A03/MF A01

Translations of articles from USSR periodicals and books are presented. The areas of materials science presented are: analysis and testing; composite materials; ferrous metals; nonferrous metals, alloys, brazes, and solders; nonmetallic materials; preparation; welding, brazing, and soldering; and extractive metallurgy and mining. For individual titles, see N89-11811 through N89-11812.

N89-11811# Joint Publications Research Service, Arlington, Va.
COMPOSITES: FUTURE DEVELOPMENT AND USE DISCUSSED c24
D. Pipko, ed. *In its* JPRS Report: Science and Technology. USSR: Materials Science 25 Apr. 1988 p 3-11 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 27 Oct. 1987 p 2 (For primary document see N89-11810 03-23)
Avail: NTIS HC A03/MF A01

Composite materials, which combine high strength with light weight and durability, are promising a real breakthrough in the machine building and other branches of the USSR economy. Application of composites in machines, equipment and structures makes it possible to reduce mass of structures by 25 to 50 percent, labor consumption in manufacturing by a factor of 1.5 to 3, energy consumption in production by a factor of 8 to 10, and material consumption by a factor of 1.6 to 3.5. Using composites, one can increase equipment service life by a factor of 1.5 to 3, reduce losses to corrosion to a minimum and reduce consumption of fuel by mobile equipment and vehicles. How these feats can be accomplished and utilized is the subject of the discussion. E.R.

N89-11812# Joint Publications Research Service, Arlington, Va.
CRYSTALS: NEW SCIENTIFIC DISCOVERY c76
R. Akhmetov *In its* JPRS Report: Science and Technology. USSR: Materials Science 25 Apr. 1988 p 23-24 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 30 Oct. 1987 p 2 (For primary document see N89-11810 03-23)
Avail: NTIS HC A03/MF A01

Silicon and gallium arsenide remain the basic semiconductor materials. For this purpose they must be extremely pure and must have extremely perfect structure. Only a single impurity atom is permitted for millions or even billions of atoms of the basic material. Lately, compounds of various natural elements, chiefly elements from the third and fifth groups of the periodic table, are increasingly used as semiconductor materials. It has been thought that an excess of one component in such a compound results in the appearance of micro-voids (vacancies) in a crystal. However, USSR scientists have shown that the atoms of the component present in excess can form, in addition to vacancies, areas of increased concentration of such atoms. This results in unusual changes in the crystal properties. The specific resistance changes suddenly, and optical, electrical, and mechanical properties either improve or deteriorate. This discovery makes it possible to reliably obtain semiconductor materials with desired properties. This discovery is further discussed. Author

N89-11813# Applied Research Lab., State College, Pa.
A NEW TYPE OF HETEROGENEOUS CATALYST WITH ISOLATED FE-RH DIATOMIC SITES M.S. Thesis
James J. Hickman, Jr. Jun. 1988 78 p
(AD-A197023; ARL/PSU/TR-88-004) Avail: NTIS HC A05/MF A01 CSCL 07B

A totally new type of heterogeneous catalyst was created containing iron rhodium diad sites. These sites were totally different from traditional iron-rhodium alloy catalysts. They exhibited a constant selectivity and specific activity with the test reaction. These sites were prepared by the low temperature decomposition of an organometallic compound, (CO)3Fe(mu-C7H7)RhCOD, in a hydrogen atmosphere. The method of characterization employed involved the catalysts' selectivity towards the isomerization and hydrogenation of 1-butene. Catalysis was accomplished using a plug-flow differential microreactor at 30 C. These diad sites also appeared to be different from rhodium-only catalysts at monoatomic dispersions. GRA

N89-11814*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POLYPHENYLQUINOXALINES VIA AROMATIC NUCLEOPHILIC DISPLACEMENT Patent Applications
Paul M. Hergenrother and John W. Connell 28 Sep. 1988 14 p
(NASA-Case-LAR-13988-1; NAS 1.71:LAR-13988-1; US-Patent-Appl-SN-250661) Avail: NTIS HC A03/MF A01 CSCL 07A

Polyphenylquinoxalines are produced by an aromatic nucleophilic displacement reaction involving an activated aromatic dihalide with an appropriate quinoxaline monomer. Polyphenylquinoxalines are high temperature thermoplastics used as adhesives, coatings, films and composite matrices. The novelty of this invention is threefold: (1) some of the quinoxaline monomers are new compositions of matter; (2) the phenylquinoxaline polymers which are the end products of the invention are new compositions of matter; and (3) the method of forming the polymers is novel, replacing a more costly prior art process, which is also limited in the kinds of products prepared therefrom. NASA

N89-11815*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATERIALS TECHNOLOGY ASSESSMENT FOR A 1050 K STIRLING SPACE ENGINE DESIGN
Coulson M. Scheuermann, Robert L. Dreshfield, Darrell J. Gaydosh, James D. Kiser, Rebecca A. MacKay, David L. McDaniels, Donald W. Petrasek, Raymond D. Vannucci, Kenneth J. Bowles, and Gordon K. Watson Oct. 1988 35 p
(NASA-TM-101342; E-4362; NAS 1.15:101342) Avail: NTIS HC A03/MF A01 CSCL 07A

An assessment of materials technology and proposed materials selection was made for the 1050 K (superalloy) Stirling Space Engine design. The objectives of this assessment were to evaluate previously proposed materials selections, evaluate the current state-of-the-art materials, propose potential alternate materials selections and identify research and development efforts needed to provide materials that can meet the stringent system requirements. This assessment generally reaffirmed the choices made by the contractor. However, in many cases alternative choices were described and suggestions for needed materials and fabrication research and development were made. Author

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials.*

N89-11816# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
X-RAY DIFFRACTION TEXTURE STUDIES OF GRAPHITE ARTICLES
V. V. Skvortsov and S. I. Alekseev 1987 16 p In RUSSIAN
(DE88-703133; IAE-4396/11) Avail: NTIS (US Sales Only) HC A03/MF A01

X-ray techniques for study of texture in graphite articles are developed. Construction of whole pole figures gives the picture of normal distribution of basis planes and permits to disclose directions in articles, where maximum anisotropy of properties is possible. The obtained data permit to determine coefficients of anisotropy of physical and mechanical properties, particularly, radiation growth and thermal expansion by means of existing analytical expressions. Examples of different texture specimens cut off graphite blocks produced according to various procedures are presented. Study of texture of spherical articles exhibited essential difference in coefficients of anisotropy in surface and deep layers of these articles, that may essentially affect variation of their dimensions under radiation. DOE

N89-11817# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE EFFECTS OF PLY DROPOFFS ON THE TENSILE BEHAVIOR OF GRAPHITE/EPOXY LAMINATES M.S. Thesis
Raymond K. Cannon 1988 176 p
(AD-A196485; AFIT/CI/NR-88-118) Avail: NTIS HC A09/MF A01 CSCL 11D

The effects of ply dropoffs on the stress-strain behavior, fracture modes and fracture strength of graphite/epoxy laminates in tension were investigated. Seven different layups with ply dropoffs were manufactured and tested to failure in uniaxial tension. Test variables included the number, order, angular orientation, and effective ply thickness of dropped plies. With six of the ply dropoff laminates, one side of the laminate was flat, with the outer plies of the other side of the laminate curving over the ply dropoff from the undropped, or thicker, section to the dropped section. This type of laminate is geometrically unsymmetric, and therefore bending stresses are induced in the laminate during testing. The analysis method developed was a one-dimensional model which allows the calculation of first ply failure of a ply dropoff laminate taking into account this induced bending effect. GRA

N89-11818# Naval Ocean Systems Center, San Diego, Calif.
PREDICTING MICROBENDING LOSSES IN SINGLE-MODE FIBERS
N. T. Kamikawa May 1988 8 p
(AD-A196565) Avail: NTIS HC A02/MF A01 CSCL 20F

Conventional techniques for evaluating microbending resistance in single-mode fibers using basketweave (1), pin (2), drum (3), and sandpaper tests depend on excess loss measurements. These tests can evaluate one fiber against another, but the stresses induced in the fiber may not be representative of cable structures or other environments. An alternative evaluation method involves predicting excess losses using a model based on Petermann's microbending theory (4), which depends on mode-field radius, and geometry of the microbends. This method is demonstrated by predicting the excess losses in two prevision-wound spools of fiber. GRA

N89-11819# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DIMUNITION AND LONGITUDINAL SPLITTING OF CARBON FIBERS DUE TO GRINDING M.S. Thesis
John F. Seibert 1988 56 p
(AD-A196697; AFIT/CI/NR-88-70) Avail: NTIS HC A04/MF A01 CSCL 11D

Lightweight composite materials composed of a carbon fiber/epoxy resin matrix are being used in increasing quantities in the aircraft production and the aerospace industry. The use of these composites is also expanding to the non-aerospace industries. Carbon fibers may become a potential airborne hazard during drilling and machining of composite materials. Air sampling by some investigators have indicated that all airborne fibers are of their original diameter (6 to 8 microns), and are non-respirable, while others have noted longitudinal fracturing of fibers into smaller diameter respirable fibers. This research was performed to determine the degree of fracturing during grinding, and to compare this fracturing to that of glass fibers. Carbon and glass fibers without epoxy resin or sizing material were ground in a ball mill. The resulting particles were very similar for carbon and glass. GRA

N89-11820# American Cyanamid Co., Bound Brook, N. J. Chemical Research Div.
IMPROVED GRAPHITE FIBER/ACETYLENE TERMINATED MATRIX RESIN PREPREG PRODUCTS Final Report, 1 Feb. 1985 - 24 Aug. 1987
J. Courter, S. Kaminski, S. Peake, D. Kohli, and R. Evans Mar. 1988 187 p
(Contract F33615-84-C-5050)
(AD-A197542; AFWAL-TR-87-4151) Avail: NTIS HC A09/MF A01 CSCL 11D

Acetylene terminated resin formulations were screened and selected in order to provide a composite matrix resin that retained the excellent hot/wet properties of the acetylene terminated resins themselves, but improved on their toughness. Resin formulations were screened in neat resin form and the three formulations having the best balance of toughness and hot/wet properties, as well as good handling characteristics, were scaled-up to tape using unsized AS-4 fiber. A formulation, designated CATB-44, had the best balance of properties and was selected for further optimization. Properties of CATB-44 reinforced with either AS-4, T300, T500, T40, or IM7 were compared. T300 provided the best edge delamination and 90 degree flexural strength, and AS-4 the worst. GRA

N89-11821# Pennsylvania State Univ., University Park.
SYNTHESIS OF ZnS WHISKERS Technical Report No. 4
T. A. Guiton and C. G. Pantano 11 Jul. 1988 21 p
(Contract N00014-86-K-0191)
(AD-A197663) Avail: NTIS HC A03/MF A01 CSCL 11D

One approach to improving the mechanical performance of a material is to form a self-similar whisker reinforced composite. This is the approach we are developing for Zinc Sulfide optical windows; however, it has necessitated the development of synthesis methods for ZnS whiskers. Recently, we reported an organometallic route to ZnS whiskers. Here we report yet another synthesis route. This non-organic route involves the surface reaction of metallic zinc foil or wire in a flowing atmosphere of Hydrogen Sulfide. The ZnS whiskers created at the zinc surface were characterized using SEM, TEM, SIMS, and X-ray diffraction. After an 8 hour 350C thermal treatment, the whiskers were of ZnS and averaged 19.2 micrometers in length, aspect ratio 27. The whiskers are single crystal in nature, and appear to evolve through an oxide layer at the surface of the zinc substrate. Thermochemical analysis of the reaction was performed to establish the relative stability of ZnS and various oxide and sulfates, and these confirmed the experimental data. These calculations describe the effects of temperature and gas phase composition on the thermochemical stability of ZnS and other solid phase reaction products. The calculations are exceedingly useful for determining and controlling the process parameters and for the evaluation of the experimentally observed products. GRA

N89-11822# Battelle Columbus Labs., Research Triangle Park, N.C.
IN-PLANE STRESS WAVES FOR NDE (NONDESTRUCTIVE EVALUATION) OF GRAPHITE FIBER/EPOXY COMPOSITES Final Report, 1 Jun. - 9 Aug. 1985
Roy F. Pellerin Apr. 1988 68 p
(Contract DAAG29-81-D-0100)
(AD-A197718; MTL-TR-88-10) Avail: NTIS HC A04/MF A01 CSCL 11D

Due to the complexity of the physical structure of composites, Non Destructive Testing (NDE) techniques which evaluate structural properties are required rather than the mere detection of inclusions, voids or discontinuities. This paper describes NDE techniques that have been used for evaluation of properties in wood, a natural composite, and the results of utilizing longitudinal stress waves for evaluation of graphite fiber/epoxy composites. The objectives of this study were:(1) to become familiar with graphite fiber/epoxy composites; and (2) to establish if the NDE stress wave method, for wood, is appropriate for evaluation of the properties of composites, such as, graphite fiber/epoxy. One of the conclusions of this study was that graphite fiber/epoxy composites respond to stress wave analysis similar to the natural composite, wood. GRA

N89-11823# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Structures and Mechanisms Div.
COMPOSITES DESIGN HANDBOOK FOR SPACE STRUCTURE APPLICATIONS, VOLUME 1
D. C. G. Eaton Dec. 1986 462 p
(ESA-PSS-03-1101-Issue-1-Vol-1; ISSN-0379-4059; ETN-88-93161) Copyright Avail: NTIS HC A20/MF A01

Composite material properties and applications; calculation methods for laminates; and composites design aspects for ESA programs are presented. ESA

N89-11824# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Structures and Mechanisms Div.
COMPOSITES DESIGN HANDBOOK FOR SPACE STRUCTURE APPLICATIONS, VOLUME 2
D. C. G. Eaton Dec. 1986 462 p
(ESA-PSS-03-1101-Issue-1-Vol-2; ISSN-0379-4059; ETN-88-93162) Copyright Avail: NTIS HC A20/MF A01

Load transfer and design of joints for composite structures; structural design; integrity control; verification guidelines; and manufacturing aspects for ESA programs are presented. ESA

N89-11825# Centre Technique des Industries Mecaniques, Senlis (France).
PRELIMINARY STUDY ON OPTIMIZED DESIGN OF STRUCTURES OF COMPOSITE MATERIALS Final Report [PRE-ETUDE CONCERNANT LA CONCEPTION OPTIMISEE DES STRUCTURES EN MATERIAUX COMPOSITES]
H. Sabzevari Dec. 1986 81 p In FRENCH
(CETIM-106870; ETN-88-93304) Copyright Avail: NTIS HC A05/MF A01

A method to calculate optimal layer thickness, the minimum total thickness, and the optimal orientation of layers is proposed. The existing analytical and numerical methods are reviewed. The analysis leads to the choice of an indirect finite element method based on the use of weighting functions, the Davidson-Fletcher-Powell variable metric method and a quadratic interpolation of the latter. The results are moderately accurate, but nevertheless acceptable. ESA

N89-11826*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF LENGTH OF CHOPPED PRISTINE AND INTERCALATED GRAPHITE FIBERS ON THE RESISTIVITY OF FIBER NETWORKS
James R. Gaier and Mark Stahl (Cleveland State Univ., Ohio.) 1988 13 p Presented at the Fall Meeting of the Materials Research Society, Boston, Mass., 28 Nov. - 2 Dec. 1988
(NASA-TM-101395; E-4474; NAS 1.15:101395) Avail: NTIS HC A03/MF A01 CSCL 11D

Samples of Amoco P-100 fibers were chopped to lengths of 3.14, 2.53, 1.90, 1.27, 0.66 mm, or milled for 2 hours. The two-point resistivity of compacts of these fibers were measured as a function of pressure from 34 kPa to 143 MPa. Samples of each fiber length were intercalated with bromine at room temperature and similarly measured. The low pressure resistivity of the compacts decreased with increasing fiber length. Intercalation lowered the resistivity of each of the chopped length compacts, but raised the resistivity of the milled fiber compacts. Bulk resistivity of all samples decreased with increasing pressure at similar rates. Even though fiber volumes were as low as 5 percent, all measurements exhibited measurable resistivity. A greater change with pressure in the resistance was observed for shorter fibers than for longer, probably an indication of tighter fiber packing. Intercalation appeared to have no effect on the fiber to fiber contact resistance. Author

N89-11827*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
STRUCTURAL EFFICIENCY STUDY OF COMPOSITE WING RIB STRUCTURES
Gary D. Swanson, Zafer Gurdal, and James H. Starnes, Jr. Sep. 1988 211 p
(Grant NAG1-343)
(NASA-CR-183004; NAS 1.26:183004; CCMS-88-18; VPI-E-88-29) Avail: NTIS HC A10/MF A01 CSCL 11D

A series of short stiffened panel designs which may be applied to a preliminary design assessment of an aircraft wing rib is presented. The computer program PASCO is used as the primary design and analysis tool to assess the structural efficiency and geometry of a tailored corrugated panel, a corrugated panel with a continuous laminate, a hat stiffened panel, a blade stiffened panel, and an unstiffened flat plate. To correct some of the shortcomings in the PASCO analysis when shear is present, a two step iterative process using the computer program VICON is used. The loadings considered include combinations of axial compression, shear, and lateral pressure. The loading ranges considered are broad enough such that the designs presented may be applied to other stiffened panel applications. An assessment is made of laminate variations, increased spacing, and nonoptimum geometric variations, including a beaded panel, on the design of the panels. Author

N89-11828# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.
DEVELOPMENT OF FRACTURE MECHANICS MAPS FOR COMPOSITE MATERIALS (COMPRESSION LOADING), VOLUME 1 Final Report
H. W. Bergmann, comp., K. Schmidt, R. Prinz, M. Gaedke, W. Hartung, R. Schuetze, W. Hillger, J. Block, H. Eggers, and H. C. Goetting et al. Paris, France ESA Apr. 1988 220 p
(Contract ESTEC-6400/85-NL-PB(SC))
(ESA-CR(P)-2645-Vol-1; ETN-88-93174) Avail: NTIS HC A10/MF A01

The fracture behavior of fiber-reinforced composites in the compression loading regime was studied to gain understanding of failure phenomena. The response of test specimens under a broad range of material, loading and environmental parameters was investigated. By combining an evaluation of global laminate properties with an evaluation of micro- and macroscopic modes of failure, the understanding of the fracture and fatigue behavior of carbon fiber-reinforced composites was enhanced. Test facilities; test specimens; nondestructive tests; analysis tools; response of laminates under static compression loading; response of unnotched laminates to fatigue loading; and investigations of laminates with central holes are described. ESA

N89-11829# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. for Structural Mechanics.
DEVELOPMENT OF FRACTURE MECHANICS MAPS FOR COMPOSITE MATERIALS (COMPRESSION LOADING), VOLUME 2 Final Report
H. W. Bergmann, comp., K. Schmidt, R. Prinz, M. Gaedke, W. Hartung, R. Schuetze, W. Hillger, J. Block, H. Eggers, and H. C. Goetting Paris, France ESA Apr. 1988 222 p
(Contract ESTEC-6400/85-NL-PB(SC))
(ESA-CR(P)-2645-Vol-2; ETN-88-93175) Avail: NTIS HC A10/MF A01

The fracture behavior of fiber-reinforced composites in the compression loading regime was studied to gain understanding of failure phenomena. The response of test specimens under a broad range of material, loading and environmental parameters was investigated. By combining an evaluation of global laminate properties with an evaluation of micro- and macroscopic modes of failure, the understanding of the fracture and fatigue behavior of carbon fiber reinforced composites was enhanced. Responses of laminates containing delaminations; influence of thermal cycling on material properties; analytic considerations of damage mechanics; an analytical approach to delamination growth in multidirectional laminates; and time dependent behavior of laminates under multiple environmental conditions are described. ESA

N89-11811# Joint Publications Research Service, Arlington, Va.
COMPOSITES: FUTURE DEVELOPMENT AND USE DISCUSSED
D. Pipko, ed. *In its* JPRS Report: Science and Technology. USSR: Materials Science 25 Apr. 1988 p 3-11 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 27 Oct. 1987 p 2 (For primary document see N89-11810 03-23)
Avail: NTIS HC A03/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N89-11830# Argonne National Lab., Ill. Fusion Power Program.
SUMMARY OF MECHANICAL PROPERTIES DATA AND CORRELATIONS FOR Li2O, Li4SiO4, LiAlO2 AND Be
M. C. Billone and W. T. Grayhack Apr. 1988 43 p
(Contract W-31-109-eng-38)
(DE88-013794; ANL/FPP/TM-218) Avail: NTIS HC A03/MF A01

The data base for thermal expansion, elastic constants, compressive and tensile failure strengths and secondary thermal creep of leading solid-breeder (Li2O, Li4SiO4, and LiAlO2) and multiplier (Be) materials is reviewed, porosity, grain size, and stress (for thermal creep). Because the data base is rather sparse in some areas, general properties of ceramics and metals are used to help guide the formulation of the correlations. The primary purpose of the data base summary and correlation development is to pave the way for stress analysis sensitivity studies. These studies will help determine which properties are important enough to structural lifetime and deformation assessments to require more data. DOE

N89-11831# National Bureau of Standards, Gaithersburg, Md. Chemical Thermodynamics Div.
THERMODYNAMIC PROPERTIES OF HALIDES, HYDRIDES AND DEUTERIDES OF COBALT, IRON AND NICKEL. 1: LITERATURE CITATIONS Final Report
C. R. Jackson and M. W. Chase Dec. 1987 53 p
(PB88-201603; NBS-TN-1244-Pt-1) Avail: NTIS HC A04/MF A01; also available SOD HC $2.75 as 003-003-02859-2 CSCL 07D

A bibliographic collection is provided on data which are necessary for the calculation of the thermochemical properties of the gaseous metal halides, hydrides (deuterides), and their positive and negative ions (MX, MX+, and MX-), where M = Co, Fe, Ni and X = Br, Cl, F, H(D), and I. This is the first in a series of articles that will document the information used in the critical evaluation of the thermodynamic properties of these substances for the JANAF Thermochemical Tables. The collection contains references which were published through the end of 1986 with some 1987 references. Fifteen bibliographies are given, one for each species. In all the bibliographies, the references are listed chronologically; alphabetically by first author within each year. The namces of the species are given according to the Chemical Abstracts system of nomenclature when possible. The Chemical Abstracts Registry Numbers, assigned, are also given for each of the species. A brief summary of the type of available information is given. GRA

N89-11832# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki.
INSTALLATION FOR PURIFICATION OF LIQUID RARE GASES WITH VOLUME TO 100 l BY MEANS OF THE SPARK TECHNIQUE
S. N. Anisimov, A. S. Barabash, A. I. Bolozdynya, and V. N. Stekhanov 1987 12 p In RUSSIAN
(DE88-702887; ITEF-106(1987)) Avail: NTIS (US Sales Only) HC A03/MF A01

An installation for purification of liquid rare gases with volume up to 100 l by means of a titanium powder sputtered into liquids by spark discharge has been constructed. In this installation 5 and 25 liquid krypton have been purified up to the electron capture length L=24 and 3 cm, respectively, in electric field E=2 kVcm at the temperature 135 K. Moreover it has been shown that a gaseous krypton are purified with help of the nickel on kizilgure

(NiSiO2) absorber from electronegative impurities. In this way in 5 of liquid krypton the electron capture length 3 cm (E=2 kVcm) have been achieved. DOE

N89-11833# Mainz Univ. (West Germany). Inst. fuer Physik.
THE ON-LINE RESONANCE IONIZATION MASS SPECTROSCOPY OF SHORT-LIVED ISOTOPES
G. Bollen, A. Dohn, H. J. Kluge, U. Kroenert, and K. Wallmeroth Oct. 1986 11 p Presented at the Resonance Ionization Spectroscopy and Its Application, Swansea, United Kingdom, 7 Sep. 1986 Prepared in cooperation with European Organization for Nuclear Research, Geneva, Switzerland
(DE88-900413; CERN-EP-86-145; CONF-8609132-17) Avail: NTIS HC A03/MF A01

On-line resonance ionization mass spectroscopy (RIMS) is discussed in order to study short-lived iostopes produced at on-line isotope separators. We report on a first application of RIMS to a determination of the isotope shift and hyperfine structure of Au-185 to Au-189 and the I = isomer-112 of Au-189 in the Sup 2S sub y2 yields 6p sup 2P sub 6p P 2 (lambda = 268 nm) transition. The Au atoms were obtained as daughters of mass-separated Hg isotopes produced at the ISOLDS facility at CERN. DOE

N89-11834# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.
THE ADSORPTION OF H2 D2 ON Fe (100)-KINETICS AND ENERGETICS Interim Report, 1 Mar. 1986 - 28 Feb. 1988
Edward A. Kurz and John B. Hudson 28 Feb. 1988 8 p
(Contract N00014-86-K-0259)
(AD-A196487; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07D

The adsorption behavior of H2 and D2 have been studied on an Fe(110) single crystal surface using a combination of thermal energy atom scattering (TEAS) and angle resolved thermal desorption spectroscopy (ARTDS). TEAS has been used to monitor adlayer coverage during adsorption, desorption and at equilibrium over a range of constant temperatures; and during temperature programmed desorption. ARTDS has been used to measure the desorption flux as a function of surface polar angle during temperature programming following adsorption at low temperature. H2 and D2 adsorb directly, dissociatively, with an activation energy for adsorption of slightly less than 1 Kcal/mol, and an initial sticking coefficient of about 0.1, independent of temperature. GRA

N89-11835# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.
THE REACTION OF HYDROGEN WITH OXYGEN ON A POLYCRYSTALLINE IRON SURFACE Interim Report No. 5, 1 Mar. 1986 - 28 Feb. 1988
Mehran Arbab and John B. Hudson 28 Feb. 1988 7 p
(Contract N00014-86-K-0259)
(AD-A196488) Avail: NTIS HC A02/MF A01 CSCL 11F

The interaction between hydrogen and oxygen on a polycrystalline iron sample is studied using Auger electron spectroscopy (AES) and mass spectrometry. A hydrogen permeation method was used. It was found that chemisorbed oxygen cannot be removed by reaction with adsorbed hydrogen, while oxygen incorporated into the near surface region of the bulk is titrated rapidly, to leave a constant amount of (Chemisorbed) oxygen on the surface, independent of reaction temperature. All results, including both the titration data obtained by AES and the water formation and desorption rates determined by mass spectroscopy, could be interpreted with an overall activation energy of 16.0 + 2.6 Kcal/mole. Of this total energy, 8.5 + 0.4 Kcal/mole was determined to be due to the kinetics of hydrogen permeation through the iron sample. GRA

N89-11836# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.
THE KINETICS AND MECHANISM OF OXYGEN UPTAKE ON A POLYCRYSTALLINE IRON SURFACE Interim Report, 1 Mar. 1986 - 28 Feb. 1988
Mehran Arbab and John B. Hudson 28 Feb. 1988 43 p Prepared in cooperation with Case Western Reserve Univ., Cleveland, Ohio
(Contract N00014-86-K-0259)
(AD-A196489; TR-6) Avail: NTIS HC A03/MF A01 CSCL 07B

The initial uptake of oxygen has been studied on a clean, polycrystalline iron surface over the temperature range between 360 and 575 K, using a combination of Auger electron spectroscopy and mass spectrometry. An initial chemisorption period is followed in turn by a temperature dependent linear oxidation regime and a final period of decreasing oxidation rate. Chemisorption kinetics can be explained by an intrinsic molecular precursor mechanism. The linear oxidation period involves uptake into the near-surface bulk by a non-activated place exchange mechanism. GRA

N89-11837# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.
THE TITRATION OF OXYGEN ON A POLYCRYSTALLINE IRON SURFACE BY PERMEATING HYDROGEN Interim Report, 1 Mar. 1986 - 28 Feb. 1988
Mehran Arbab and John B. Hudson 28 Feb. 1988 48 p Prepared in cooperation with Case Western Reserve Univ., Cleveland, Ohio
(Contract N00014-86-K-0259)
(AD-A196490; TR-7) Avail: NTIS HC A03/MF A01 CSCL 07B

The interaction between oxygen and hydrogen on a clean polycrystalline iron surface was studied by Auger electron spectroscopy and mass spectrometry. To avoid having the reaction kinetics limited by the slow adsorption of hydrogen on the oxidized surface, hydrogen was supplied by permeation through the thin iron specimen. For oxygen coverages of more than one monolayer, this procedure resulted in the rapid titration of oxygen by the formation and desorption of water. In the temperature range of 475 to 625 K, the reaction path consists of the initial formation of OH from coadsorbed oxygen and hydrogen, followed by the disproportionation of two hydroxyl species to form H2O. An overall activation energy of 7 to 8 Kcal/mole was measured for the above reaction sequence. Oxygen in coverages of less than one monolayer could not be removed by hydrogenation, in agreement with a previous study on an Fe(100) single crystal substrate. The present study shows that this apparent stability of the chemisorbed oxygen is not due to the kinetics of hydrogen adsorption. GRA

N89-11838# Texas A&M Univ., College Station. Dept. of Chemistry.
MACROCYCLES CONTAINING TIN: A SMALL EXCLUSIVE HOST FOR THE FLUORIDE ION Technical Report No. 11
Martin Newcomb and Michael T. Blanda 31 May 1988 13 p
(Contract N00014-79-C-0584)
(AD-A196616) Avail: NTIS HC A03/MF A01 CSCL 07B

The binding of halide ions by host 1 (1, 8-dichloro-1,8-distanna-bicyclo(6.6.6)eicosane) in solution have been studied Nuclear Magnetic Resonance (NMR) spectroscopy. In CDCl3 solutions, host 1 maintains its structural integrity in the presence of tetraalkylammonium halides. Host 1 shows no binding properties towards chloride, bromide or iodide ions. Molecular recognition of anionic guests by multidentate, Lewis acidic hosts in organic media has been observed in only limited cases. Further, neutral, macrocyclic receptors for anions or bases have just begun to receive properties of a series of Lewis acidic macrobicyclic hosts (1 to 4) containing bridgehead tin atoms. GRA

N89-11839# Amherst Coll., Mass. Dept. of Chemistry.
SURFACE ENHANCED RAMAN MEASUREMENT OF THE OXIDATION REACTIONS OF GASES ON METAL SURFACES Final Report, 1 Mar. 1986 - 29 Feb. 1988
Paul B. Dorain May 1988 6 p
(Contract N00014-85-K-0105)
(AD-A196728) Avail: NTIS HC A02/MF A01 CSCL 07B

This program applied the technique of Surface Enhanced Raman Scattering to study the decomposition of organophosphonates on metal surfaces (microstructures) towards the goal of effective decontamination. Reaction kinetics were studied, the product distributions were observed. Outgrowths of this research are studies of corrosion and passivation of Ag by the reactions of the oxyanions CrO4 and MnO4 in electrochemical cells which resulted from research into the adsorption properties of protonated phosphates. GRA

N89-11840# SRI International Corp., Menlo Park, Calif.
THE USE OF LASER-POWERED HOMOGENEOUS PYROLYSIS TO DETERMINE THE INITIAL STEPS IN THE HOMOGENEOUS GAS-PHASE DECOMPOSITION OF CYCLIC NITRAMINES Final Report, 1 Jan. 1985 - 31 Dec. 1987
Donald F. McMillen, Paul H. Stewart, S. E. Nigenda, Jay B. Jeffries, and Jean-Michel Zellweger 28 Apr. 1988 113 p
(Contract F49620-85-K-0006)
(AD-A196879; AFOSR-88-0609TR) Avail: NTIS HC A06/MF A01 CSCL 07C

As a prototype for more complex nitramines, the gas-phase decomposition of dimethylnitramine has been studied experimentally in two different laser-pyrolysis systems and theoretically using ab initio quantum mechanical calculations. Our studies, unlike those reported in the literature, indicate that a nitro-nitrite rearrangement pathway is competitive with the expected (and previously invoked) N-NO2 bond scission. This rearrangement pathway has been obscure because it can lead to some of the same products as are yielded by the bond scission route. The principal evidence for nitro-nitrite rearrangement is: (1) Arrhenius parameters for decomposition that are two orders of magnitude too low to be consistent with simple N-NO2 bond scission as the sole rate-determining step; (2) molecular-beam, mass-spectrometrically-sampled laser pyrolysis studies that show direct detection of NO and the nitroxyl radical (CH3)2NNO on a time scale too short to allow for the production of these substances in secondary bimolecular reactions; and (3) ab initio calculations that find a rearrangement pathway at slightly lower energy than that of simple bond scission. GRA

N89-11841# Energy and Environmental Research Corp., Irvine, Calif.
KINETICS OF NITROGEN AND SULFUR REACTIONS IN COMBUSTION SYSTEMS Quarterly Report No. 11
1988 91 p
(Contract DE-AC22-84PC-70771)
(DE88-012962; DOE/PC-70771/T9) Avail: NTIS HC A05

Four segments of the contract Kinetics of Sulfur and Nitrogen Reactions in Combustion Systems are summarized in this report: 1. Results of recent kinetic modeling studies of advanced applications of additives for NO sub x control-side chamber design studies. 2. Status of fundamental laboratory experiments investigating the potential of several compounds for NO sub x control in combustion systems. 3. Development status of the inert calcimer for SO2 sorbent preparation. 4. An update on fundamental studies of sorbent calcination kinetics. The overall program is designed to support one goal: Develop the crucial fundamental mechanistic and quantitative rate information on the chemistry of formation and control of sulfur and nitrogen oxides as they pertain to pulverized coal fired systems. Separate abstracts were prepared for each section, and entered in the Energy Data Base. DOE

N89-11842# California Univ., Berkeley. Lawrence Berkeley Lab. Center for Advanced Materials.
MICROSTRUCTURAL STUDY OF AN IRON SILICATE CATALYST USING ELECTRON MICROSCOPY
R. Csencsits and R. Gronsky Jun. 1988 15 p Presented at the 196th American Chemical Society National Meeting, Los Angeles, Calif., 25 Sep. 1988
(Contract DE-AC03-76SF-00098)
(DE88-014815; LBL-25173-Rev; CONF-880912-13-Rev) Avail: NTIS HC A03/MF A01

The effects of various synthesis conditions on the structure of iron silicate analogs of zeolite ZSM-5 were considered. Scanning electron microscopy (SEM) was used to determine the particle size distributions and morphologies. Particle sizes vary from tenths of a micron to several microns, depending on degree of agitation during crystal growth, while morphology is additionally dependent on the concentration of iron in the gel during crystallization. Transmission electron microscopy (TEM) was used to determine the size and spatial distributions of iron-rich (as compared to the FeZSM-5 matrix) second phase particles within the ZSM-5 framework as a function of SiO sub 2 Fe sub 2 O sub 3- ratio, thermal and hydrothermal treatments. DOE

N89-11843# Lawrence Livermore National Lab., Calif.
COMPUTER MODELING OF AUTOIGNITION CHEMISTRY
C. K. Westbrook and W. J. Pitz 25 Jul. 1988 51 p Presented at the 2nd International Symposium on Computation Chemistry on Cray Computers, Chicago, Ill., 11 Sep. 1988
(Contract W-7405-eng-48)
(DE88-015451; UCRL-99324; CONF-8809117-1) Avail: NTIS HC A04/MF A01

The development of detailed chemical kinetic reaction mechanisms for analysis of autoignition and knocking of complex hydrocarbon fuels is described. The wide ranges of temperature and pressure which are encountered by end gases in automobile engine combustion chambers result in extreme demands on the reaction mechanisms intended to describe knocking conditions. The reactions and chemical species which are most important in each temperature and pressure regime are discussed, and the validation of these reaction mechanisms through comparison with idealized experimental results is described. The use of these mechanisms is illustrated through comparisons between computed results and experimental data obtained in actual knocking engines. DOE

N89-11844# Pennsylvania State Univ., University Park. Dept. of Chemical Engineering.
CHARACTERIZATION OF CATALYSTS WITH METAL-SUPPORT EFFECTS AND OF THE SPECIES ADSORBED ON THEIR SURFACES Final Progress Report, 1 Sep. 1984 - 30 Aug. 1988
M. Albert Vannice Aug. 1988 11 p
(Contract DE-FG02-84ER-13276)
(DE88-016900; DOE/ER-13276/4) Avail: NTIS HC A03

The principal objectives of our research were: to gain a better understanding of the chemistry and physics which produce these metal-support effects and, as a consequence, to use this information to guide us in the development of new and improved catalyst systems for particular reactions. This is done by investigating Pt and Pd dispersed on selected supports using a multifaceted approach involving DSC, TGA, NMR, adsorption, and kinetic studies of selected probe reactions. This approach has led us to the preparation of: (1) the most active Pd catalysts to date for benzene hydrogenation; (2) the most active Pt catalysts to date (by more than an order of magnitude) for acetone hydrogenation to isopropanol; and (3) the only Pt catalysts capable of significant selectivity to crotyl alcohol during crotonaldehyde hydrogenation. Calorimetric studies using DSC have shown that the principal reason for decreased chemisorption capacity on TiO2-supported Pt and Pd is the physical blockage of metal surface by TiO sub x species rather than by a large decrease in the heats of adsorption, Q sub ad. Also a large crystallite size effect was found which increased Q sub ad values on particles smaller than 3 microns. DOE

N89-11845# Indiana Univ., Bloomington. Dept. of Chemistry.
DETECTION OF SUBPOPULATIONS IN NEAR-INFRARED REFLECTANCE ANALYSIS
Robert A. Lodder and Gary M. Hieftje 11 Jul. 1988 65 p
(Contract N00014-86-K-0366)
(AD-A197496; AD-E501007; INDU/DC/GMH/TR-39) Avail: NTIS HC A04/MF A01 CSCL 07A

In typical near-infrared multivariate statistical analyses, samples with similar spectra produce points that cluster in a certain region of spectral hyperspace. These clusters can vary significantly in shape and size due to variations in sample packings, particle-size distributions, component concentrations, and drift with time. These factors, when combined with discriminant analysis using simple distance metrics, produce a test in which a result that places a particular point inside a particular cluster does not necessarily mean that the point is actually a member of the cluster. Instead, the point may be a member of a new, slightly different cluster that overlaps the first. A new cluster can be created by factors like low level contamination or instrumental drift. An extension added to part of the BEAST (Bootstrap Error-Adjusted Single-sample Technique) can be used to set nonparametric probability-density contours inside spectral clusters as well as outside, and when multiple points begin to appear in a certain region of cluster-hyperspace the perturbation of these density contours can be detected at an assigned significance level. The detection of false samples both within and beyond 3 SDs of the center of the training set is possible with this method. This procedure is shown to be effective for contaminant levels of a few hundred ppm in an over-the-counter drug capsule. GRA

N89-11846# Indiana Univ., Bloomington. Dept. of Chemistry.
APPLICATIONS OF CELLULAR AUTOMATA: ATTRACTORS AND FRACTALS IN ANALYTICAL CHEMISTRY
Robert A. Lodder, Mark Selby, and Gary M. Hieftje 11 Jul. 1988 21 p
(Contract N00014-86-K-0366)
(AD-A197526; INDU/DC/GMH/TR-88-32) Avail: NTIS HC A03/MF A01 CSCL 12I

A cellular automation is a discrete dynamic system of simple construction, yet capable of exhibiting complex self-organizing behavior. A cellular automaton can be used to model differential systems by assuming that time and space are quantized, and that the dependent variable takes on a finite set of possible values. Cellular-automaton behavior falls into four distinct universality classes, analogous to: (1) limit points, (2) limit cycles, (3) chaotic attractors (fractals), and (4) universal computers. The behavior of members of each of these four classes is explored in the context of digital spectral filtering. The utility of class 2 behavior in experimental data analysis is demonstrated with a laboratory example. Cellular automata have contributed much to computer graphics, and they have much to contribute to chemistry and other sciences as well. Major changes in parallel processing and the implementation and role of pattern recognition are now underway. The cellular-automaton model suggests that more than just the process sensors used in pattern-recognition methods can benefit from simplification: the computers, and even the calculations themselves, can benefit from a union of simplification and parallelism. Future work, particularly in the area of parallel algorithms and the design of instruments optimized for use with such algorithms, will open up a range of applications that have yet to be imagined. GRA

N89-11847# Applied Research Lab., State College, Pa.
DEVELOPMENT OF A DATABASE OF THERMOCHEMICAL PARAMETERS FOR USE WITH THE SOLGASMIX COMPUTER PROGRAM M.S. Thesis
Jonathan A. Peters Jul. 1988 131 p
(AD-A197603; TR-88-08) Avail: NTIS HC A07/MF A01 CSCL 12E

After a brief discussion of the theory of chemical equilibrium, the computer program SOLGASMIX, for calculating thermodynamic equilibria in complex chemical systems, is described. Modifications to SOLGASMIX which allow the program to access a database of thermochemical curvefits are discussed. Additional extensions to the SOLGASMIX program, including an interactive user interface, are introduced. Several SOLGASMIX applications are presented in detail, and the results of the program compared with those of other methods. Several additional programs, which allow the user to incorporate the curvefit database in other applications, are described. A number of input examples are given for each of the various programs, and data punching guides are given where appropriate. The various operating systems supporting the SOLGASMIX system are discussed. An index listing the species in the curvefit database is included. GRA

N89-11848# Indiana Univ., Bloomington. Dept. of Chemistry.
CHARACTERIZATION OF THE MICROWAVE-INDUCED PLASMA AS A DETECTOR FOR SUPERCRITICAL FLUID CHROMATOGRAPHY
Leonard J. Galante, Mark Selby, Debra R. Luffer, Gary M. Hieftje, and Milos Novotny 11 Jul. 1988 42 p
(Contract N00014-86-K-0366)
(AD-A197709; INDU/DC/GMH/TR-88-30) Avail: NTIS HC A03/MF A01 CSCL 20E

A microwave induced plasma (MIP) sustained in helium is evaluated as an element selective detector for capillary supercritical fluid chromatography (SFC). The plasma source, a surface microwave induced plasma (surfatron), is described. Optimal plasma conditions including viewing position, helium flow rate, and applied microwave power are discussed for sulfur emission in the near-infrared spectral region. In addition, the effects of two common mobile phases (CO_2 and N_2O) on plasma stability, sensitivity, and spectral background from 200 nm to 1100 nm are assessed. Although the plasma was evaluated principally for use with SFC, much of the discussion is relevant to its application as a gas chromatographic detector. GRA

N89-11849# Indiana Univ., Bloomington. Dept. of Chemistry.
DEVELOPMENTS IN PLASMA-SOURCE MASS SPECTROMETRY
Gary M. Hieftje and George H. Vickers 11 Jul. 1988 53 p
(AD-A197732; INDU/DC/GMH/TR-88-41) Avail: NTIS HC A04/MF A01 CSCL 07D

The field of plasma-source mass spectrometry is critically reviewed and its current status assessed. An overview of PS-MS applications is provided and a discussion is offered of key problem areas that currently exist in the field. Areas that are now receiving strong research attention are outlined and a view is offered of future prospects of plasma-source mass spectrometry as a technique for elemental analysis. GRA

N89-11850# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperfoschung.
DEVELOPMENT OF AN INTEGRATING X-RAY DETECTOR Thesis - Technische Hochschule, Aachen [ENTWICKLUNG EINES INTEGRIERENDEN ORTSAUFLOESENDEN ROENTGENDETEKTORS]
Wolfgang Hoheisel Dec. 1987 72 p In GERMAN; ENGLISH summary
(JUEL-2171; ISSN-0366-0885; ETN-88-93194) Avail: NTIS HC A04/MF A01

An X-ray detector was built with a commercially manufactured vidicon to count photons in synchrotron radiation scattering experiments. The output window of the vidicon was coupled via a demagnifying fiber optic cone to the output window of a commercially manufactured image intensifier tube. This was then coupled to a Gd_2O_2S fluorescence screen. To show the function of the integrating X-ray detector typical small angle scattering experiments were done. A readout technique for measurements of high-contrast, high-flux X-ray patterns was developed and was used in measurements with a silica aerogel. ESA

N89-11851# Karlsruhe Univ. (West Germany). Fakultaet fuer Chemieingenieurwesen.
DYNAMIC BEHAVIOR OF AXIAL DIFFUSION FLAMES AND THEIR IMPORTANCE FOR SELF-EXCITED COMBUSTION CHAMBER OSCILLATIONS Ph.D. Thesis [DAS DYNAMISCH VERHALTEN VON AXIALSTRAHL-DIFFUSIONSFLAMMEN UND DESSEN BEDEUTUNG FUER SELBSTERREGTE BRENNKAMMERSCHWINGUNGEN]
Ulrich Priesmeier 1987 179 p In GERMAN
(ETN-88-93238) Avail: NTIS HC A09/MF A01

Oscillation processes in industrial combustion chambers are studied especially for the elimination of low frequency oscillations. Gas acoustic behavior of combustion furnaces and turbulent diffusion flame driven oscillations are analyzed in laboratory experiments. Main measurements concern: gas velocity, gas density recording, isotherm free beam pulsations, concentric double beams, and concentric axial beam diffusion flames frequency. Effects of ignition stability are outlined. ESA

N89-11852# Institut Franco-Allemand de Recherches, St. Louis (France).
SIMULTANEOUS MEASUREMENTS OF PRESSURE, VELOCITY, AND GAS TEMPERATURE AT THE OUTLET OF AN EXPERIMENTAL IGNITER [SIMULTANMESSUNG VON DRUCK, GESCHWINDIGKEIT UND GASTEMPERATUR IN DER AUSTRITTSDUESE EINES EXPERIMENTIERTREIBLADUNGSANZUENDERS]
H. Mach, U. Werner, and H. Masur 4 Dec. 1986 39 p In GERMAN
(ISL-R-131/86; ETN-88-93279) Avail: NTIS HC A03/MF A01

Simultaneous measurements of pressure, gas velocity, and temperature are presented for two different types of igniters. The gas jet is directed in a closed chamber filled with inert polyethylene particles. Special optical sensors were developed for velocity and spectral beam density analysis at two different wavelengths. Condensate material deposits on the sensors are investigated for beam measurements. ESA

N89-11853 Prins Maurits Lab. TNO, Rijswijk (Netherlands).
HIGH PERFORMANCE LIQUID CHROMATOGRAPHIC SEPARATION OF DIPHENYLAMINE AND ITS REACTION PRODUCTS WITH NITROGEN OXIDES
A. L. deJong May 1987 36 p
(Contract A79/K/031)
(PML-1987-32; TD-87-6096; ETN-88-93453) Copyright Avail: Prins Maurits Lab. TNO, Inst. for Chemical and Technological Research, P.O. Box 45, 2280 AA Rijswijk, Netherlands

A high-performance liquid chromatography method that can be applied to the qualitative and quantitative analysis of DPA and its reaction products with nitrogen oxides, as well as to their determination in single base propellants, was developed. Experiments show that reversed phase chromatography offers the best separation and that Polygosil 100C18 in combination with a ternary acetonitrile-methanol-water eluent and detection at 210 nm is to be preferred. The use of methylene chloride as sample solvent limits the injection volume to 2 micro liters and may introduce impurities that could interfere with the separated peaks or lead to misinterpretation of the chromatogram. Normal phase chromatography can be used for separation of DPA and 2,4,4'NDPA, but is less suitable for most propellant analyses due to excessive retention of the accompanying compound 4,4'NDPA. ESA

N89-11854 Institut d'Aeronomie Spatiale de Belgique, Brussels.
TEMPERATURE DEPENDENCE OF ULTRAVIOLET ABSORPTION CROSS SECTIONS OF BROMINATED METHANES AND ETHANES
D. Gillotay, P. C. Simon, and L. Dierickx 1988 21 p Presented at the Quatrennial Ozone Symposium, Goettingen, Fed. Republic of Germany, 8-13 Aug. 1988 Submitted for publication
(Aeronomica-Acta-A-335-1988; ISSN-0065-3713; ETN-88-93535)
Avail: Inst. d'Aeronomie Spatiale de Belgique, 3 Avenue Circulaire, B-1180 Brussels, Belgium

Absorption cross sections of 5 brominated methanes (CH3Br, CH2Br2, CF3Br, CF2Br2 and CF2BrCl), and of 2 brominated ethanes (CF2Br-CF2Br and CF3-CHBrCl) were measured between 172 and 300 nm with a classical single beam system, for temperature ranging from 210 to 295 K. Stratospheric photodissociation coefficients (for altitude ranging from 15 to 50 km) calculated with the temperature dependent absorption cross sections, are 15 greater greater than those calculated with the room temperature values in the 20 to 35 km region, due to the increase in the absorption cross sections in the 200 nm region. The photodissociation coefficients of CH3Br and C2F4Br2 seem to be temperature independent. Tropospheric photodissociation coefficients for all these molecules are very low (between 10 to the minus 8th and minus 11th powers/sec) and are reduced down to 20 percent of their room temperature values, using the temperature dependent cross section values. Therefore, the theoretical tropospheric residence times are increased, and the production of Br radicals in the troposphere by photodissociation of brominated species may be considered as negligible. ESA

N89-11855# Royal Signals and Radar Establishment, Malvern (England).
PERFORMANCE PREDICTIONS FOR BULK CHALCOGENIDE GRATINGS PRODUCED BY THE PHOTODISSOLUTION EFFECT
C. W. Slinger Feb. 1988 37 p
(RSRE-Memo-4121; BR106726; ETN-88-93551) Copyright
Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

Gratings produced by the photodoping of chalcogenide glasses are shown to have great promise for use as diffracting elements in the red to far infrared (up to 15 microns). They are simple to fabricate, phase gratings being produced by mask exposure or holographic techniques. The performances of bulk, rectangular phase gratings is investigated using a coupled wave model and a detailed analysis performed in the thin, multiwave, and volume diffraction regimes. High efficiencies (over 97 percent) are found to be achievable in the multiwave regime. Based on data for silver doped arsenic sulfide glasses, the optimum parameters for operation at 632.8 nm, 4 microns, and 10.6 microns are calculated. The maximum efficiencies likely to be achieved and angular responses are evaluated. ESA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N89-11856 Rensselaer Polytechnic Inst., Troy, N.Y.
AN INVESTIGATION INTO THE PHYSICAL METALLURGY, WELDING METALLURGY, HOT-CRACKING AND WELD POOL SHAPE OF FERRITIC STAINLESS STEELS Ph.D. Thesis
Richard Donald Campbell 1987 416 p
Avail: Univ. Microfilms Order No. DA8803434

An investigation was performed to determine the effects of alloy composition and heat treatment on the physical metallurgy and welding metallurgy of several 18 percent and 28 percent Cr ferritic stainless steels. Results indicate that welding produced wholly ferritic structures in all regions and caused dissolution of all second phases in the fusion zone and coarse-grained heat-affected zone of the alloy containing 28 percent Cr to 5 percent Mo, which was heat treated to produce sigma and chi phases. Equiaxed-dendritic grains formed near the center of welds in several alloys. Results of Subscale Varestraint tests reveal that VIM alloys are very resistant to hot-cracking because the melting method produced very low levels of C, N, P, and S. The VIM alloys had the greatest weld depth of penetration, with depth-to-width ratios nearly twice that of the AOD-refined alloys. This difference was attributed to the greater levels of surface-active oxygen in the VIM alloys, and to niobium, titanium and other elements in the AOD-refined alloys which deoxidized the liquid weld metal, thus removing surface-active oxygen. Dissert. Abstr.

N89-11857# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Chemical Sciences Div.
HIGH-Mn STEEL WELDMENT MECHANICAL PROPERTIES AT 4K
J. W. Chan, A. J. Sunwoo, and J. W. Morris, Jr. Jun. 1988 28 p Presented at the American Welding Society Meeting, New Orleans, La., 18 Apr. 1988 Prepared in cooperation with California Univ., Berkeley
(Contract DE-AC03-76SF-00098)
(DE88-013599; LBL-25023; CONF-8804142-4) Avail: NTIS HC A03/MF A01

Advanced high-field superconducting magnets of the next generation of magnetic confinement fusion devices will require structural alloys with high yield strength and high toughness at cryogenic temperatures. Commercially available alloys used in the current generation of magnets, such as 300 series stainless steels, do not have the required properties. N-strengthened, high-Mn alloys meet base plate requirements in the as-rolled condition. However, the property changes associated with weld microstructural and chemical changes in these alloys have not been well characterized. In this work welding induced cryogenic mechanical property changes of an 18Mn-16Cr-5Ni-0.2N alloy are correlated with as-solidified weld microstructures and chemistries. DOE

N89-11858# Mound Lab., Miamisburg, Ohio.
TIME-OF-FLIGHT MASS SPECTROMETER FOR INVESTIGATING HYDROGEN ISOTOPE INTERACTIONS: H/D EXCHANGE RATES AT STAINLESS STEEL AND SILICON SURFACES
J. T. Gill, D. B. Watkins, J. N. Rigano, W. A. Clift, R. A. Watkins, A. L. Burwinkle, J. A. Schultz, L. R. Anderson, and H. K. Schmidt 1988 9 p Presented at the 3rd Topical Meeting on Tritium Technology in Fission, Fusion and Isotopic Applications, Toronto, Ontario, 1 May 1988 Prepared in cooperation with Ionwerks, Houston, Tex.
(Contract DE-AC04-76DP-00053)
(DE88-012876; MLM-3510(OP); CONF-880505-36) Avail: NTIS HC A02

Time-of-flight Secondary Ion Mass Spectrometry/Direct Recoil (TOF SIMS/DR) techniques and apparatus are described which hold substantial promise for further understanding the behavior of hydrogen isotopes at surfaces. The analytic apparatus will be interfaced to a tritium-compatible exposure cell within a glovebox by means of a vacuum load-lock. Apparatus will consist of a pulsed Li(+) beam for H/D/T ratios (DR), a dc or pulsed Cs(+) beam for sputtering or TOF/SIMS (for enhancement of negative ion yields), and a dual channel 10 MHz time-digiting histogrammer for fast data rates. Prototype apparatus has already proven useful in understanding the rates at which hydrogen isotopes may be exchanged from material surfaces upon exposure to water vapor. An extremely fast and a second much slower process characterize the exchange at Si and stainless steel opxyhydroxide surface films. The fast process is limited by the rate at which water molecules strike the top monolayer of the surface. H/D exchange tunneling appears to be the bulk diffusion-limited exchange rate within the oxyhydroxide film. Diffusion constants have been derived: D sub ex-10 sup-19 and 10 sup -20 sq cm/sec for the films on 304SS and Si, respectively, at 298K and 1.3 x 10 sup -4 Pa (10 sup -6 torr) (H2O). D sub ex for 304SS is consistent with previous results on alpha-FeOOH and SS. Diffusion exchange appears important in understanding the behavior of tritium permeation or contamination barriers. DOE

N89-11859 Illinois Univ., Urbana-Champaign.
MICROSTRUCTURAL ENHANCEMENT OF MAGNESIUM ALLOYS FOR ELEVATED TEMPERATURE APPLICATIONS USING NOVEL PROCESSING TECHNIQUES Ph.D. Thesis
Fritz Carl Grensing 1987 197 p
Avail: Univ. Microfilms Order No. DA8803055

Mg-base alloys show excellent potential for property improvement using novel processing techniques and alloying elements. These methods may be used to improve the elevated temperature behavior of Mg alloys. Additions of various amounts of Gd into Mg produced an alloy that with careful heat treatment had improved mechanical properties when compared to conventional Mg alloys. The precipitation process in these alloys was studied and a previously unreported sequence of precipitation was uncovered. Rapid solidification processing was used to produce a uniform dispersion of Mg2Si particles within the Mg matrix. The effects of rapid solidification on the microstructure of several different alloy compositions was investigated. Three different microstructures were observed in these alloys. Dissert. Abstr.

N89-11860# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Chemical Sciences Div.
FATIGUE CRACK GROWTH IN METASTABLE AUSTENITIC STAINLESS STEELS
Z. Mei, G. Chang, and J. W. Morris, Jr. Jun. 1988 13 p Presented at the International Conference on Cryogenic Materials Applications and Properties, Shenyang, People's Republic of China, 7 Jun. 1988 Prepared in cooperation with California Univ., Berkeley
(Contract DE-AC03-76SF-00098)
(DE88-013709; LBL-24949; CONF-880653-2) Avail: NTIS HC A03/MF A01

The research reported here is an investigation of the influence of the mechanically induced martensitic transformation on the fatigue crack growth rate in 304-type steels. The alloys 304L and 304LN were used to test the influence of composition, the testing temperatures 298 K and 77 K were used to study the influence of test temperature, and various load ratios (R) were used to determine the influence of the load ratio. It was found that decreasing the mechanical stability of the austenite by changing composition or lowering temperature decreases the fatigue crack growth rate. The R-ratio effect is more subtle. The fatigue crack growth rate increases with increasing R-ratio, even though this change increases the martensite transformation. Transformation-induced crack closure can explain the results in the threshold regime, but cannot explain the R-ratio effect at higher cyclic stress intensities. DOE

N89-11861# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
EMPIRICAL METHOD FOR MATRIX EFFECTS CORRECTION IN LIQUID SAMPLES. QUANTITATIVE DETERMINATION OF CHROMIUM, NICKEL AND MOLYBDENUM IN STEELS BY X-RAY FLUORESCENCE
Dora VigodadeLeyt and Cristina Vazquez 1987 19 p In SPANISH
(DE88-703113; CNEA-481) Avail: NTIS (US Sales Only) HC A03/MF A01

A simple method for the determination of Cr, Ni and Mo in stainless steels is presented. In order to minimize the matrix effects, the conditions of liquid system to dissolve stainless steels chips has been developed. Pure element solutions were used as standards. Preparation of synthetic solutions with all the elements of steel and also mathematic corrections are avoided. It results in a simple chemical operation which simplifies the method of analysis. The variance analysis of the results obtained with steel samples show that the three elements may be determined from the comparison with the analytical curves obtained with the pure elements if the same parameters in the calibration curves are used. The accuracy and the precision were checked against other techniques using the British Chemical Standards of the Bureau of Analyzed Samples Ltd. DOE

N89-11862# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
SYNTHETIC METALS FROM INTERCALATED GRAPHITE Final Report, 10 Oct. 1984 - 30 Sep. 1987
M. S. Dresselhaus and G. Dresselhaus 9 May 1988 32 p
(Contract F49620-83-C-0011)
(AD-A196354; AFOSR-88-0644TR) Avail: NTIS HC A03/MF A01 CSCL 11F

A summary is presented of research carried out over the three year period October 1, 1984 to September 30, 1987 on the program, Synthetic Metals from Intercalated Graphite. The research covers Synthesis and Compositional Characterization of Graphite Intercalation Compounds, Structural Studies, Lattice Mode Studies, Electronic Structure, Transport Properties, Magnetic Studies in Graphite Intercalation Compounds, Superconductivity Studies in Graphite Intercalation Compounds, and Review Articles and Plenary Invited Talks. GRA

N89-11863# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
THE INFLUENCE OF CATHODIC PROTECTION ON EROSION-CORROSION OF METALS AND MODEL ALLOYS Final Report, 31 Dec. 1986 - 31 Jul. 1988
Mark E. Orzaem 14 Jun. 1988 71 p
(Contract N00014-87-K-0042)
(AD-A196574; UVA/525418/CHE88/102) Avail: NTIS HC A04/MF A01 CSCL 11F

The object of this program is to develop a fundamental understanding of the influence of applied potential on mechanisms for erosion-corrosion as applied to copper and copper-based alloys. This work is intended to allow application of laboratory experiments to predict the onset of erosion-corrosion failure under field conditions and to guide development of workable strategies for prevention of erosion-corrosion. This program is being transferred to the University of Florida; therefore, this report provides a summary of the activities at the University of Virginia. In the first year of the program, an electrochemical cell incorporating a scanning ellipsometer was designed and built. The cell uses a submerged electrolyte jet impinging on an electrode. The laser spot size is around 25 x 70 micro meters, and the position of the electrode-jet assembly relative to the laser spot can be controlled by stepping motor stages without altering the hydrodynamic environment. GRA

N89-11864# Army Lab. Command, Watertown, Mass. Material Technology Lab.
HYDROGEN ASSISTED CRACKING OF HIGH STRENGTH STEEL WELDS Final Report
Steven A. Gedeon May 1988 367 p
(AD-A196738; MTL-TR-88-12) Avail: NTIS HC A16/MF A01 CSCL 11F

High strength steels, gas metal arc welds, welds, hydrogen measurement, absorption, cracking (fracturing, and hydrogen embrittlement are discussed. GRA

N89-11865# Colorado School of Mines, Golden. Center for Welding Research.
INVESTIGATION OF HIGH TEMPERATURE DUCTILITY LOSSES IN ALPHA-BETA TITANIUM ALLOYS Ph.D. Thesis Final Report
Brian K. Damkroger, B. B. Rath (Naval Research Lab., Washington, D.C.), and G. R. Edwards Apr. 1988 417 p
(AD-A196834; CSM-MT-CWR-087-041; T-3393) Avail: NTIS HC A18/MF A01 CSCL 11F

Under certain conditions, alpha-beta titanium alloys can show severely reduced high-temperature ductility. These conditions consist of loading in tension during cooling from a thermal excursion to above the beta transus. A model for this behavior, which relates the ductility loss to the volumetric incompatibility between the beta and alpha lattices during the beta to alpha transformation, has been previously proposed. This model was developed and investigated as part of an overall investigation of the ductility loss with respect to several metallurgical variables. It was found that the high-temperature ductility loss is ubiquitous in alpha-beta titanium alloys, but could not be directly related to lattice incompatibility. It was instead found that the ductility loss resulted from gross localized deformation within a particular microstructural component, lamellar Widmanstatten colonies. GRA

N89-11866# Battelle Memorial Inst., Columbus, Ohio.
IDEAL FRACTURE-RESISTANT MICROSTRUCTURES Final Report, 1 Apr. 1985 - 31 Mar. 1988
A. R. Rosenfield, J. P. Hirth, M. Manoharan, and S. Raghavachary 19 May 1988 9 p Prepared in cooperation with Ohio State Univ., Columbus
(Contract DAAG29-85-K-0035)
(AD-A197028; ARO-21673.6-MS) Avail: NTIS HC A02/MF A01 CSCL 11F

The main objective of this grant is to quantify the concept of ideal microstructures for fracture resistance. To approach this goal, a variety of steels and heat treatments was investigated. Of particular interest was the resistance of different steels to failure by shear instability, which is much less well understood than tensile instability. While some information on shear-crack initiation is available in the literature, evidence on shear-crack propagation is very limited and mainly confined to very tough steels. GRA

N89-11867# Rockwell International Corp., Golden, Colo.
FATIGUE AND STRAIN HARDENING OF SIMULATED CASE MICROSTRUCTURE IN CARBURIZED STEELS
Mark A. Zaccone and George Krauss (Colorado School of Mines, Golden.) 1988 6 p Presented at the 6th International Conference on Heat Treatment of Materials, Chicago, Ill., 28 Sep. 1988
(Contract DE-AC04-76DP-03533)
(DE88-014933; RFP-4246; CONF-8809113-1) Avail: NTIS HC A02/MF A01

Tension, compression, and cyclic stress-strain testing were used to evaluate the effect of retained austenite on high and low cycle fatigue of Cr-Mo-Ni alloy steels containing 0.8 pct C to simulate the high carbon case of carburized steels. In low cycle fatigue, cracks develop at austenite grain boundaries early during tensile and cyclic loading. Propagation of these cracks is stabilized in specimens which contain large amounts of retained austenite which dynamically forms martensite by strain-induced transformation. Without sufficient austenite, incipient cracks are not effectively stabilized, and low cycle fatigue life is reduced. In high cycle fatigue, insufficient strain accumulates for the activation of strain-induced martensite, and large amounts of retained austenite are not as beneficial as in low cycle fatigue. Microstructures with 30 to 35 volume percent retained austenite and fine mixtures of martensite and austenite which contribute to high elastic limits appear to be the most satisfactory for good high and low cycle fatigue resistance. DOE

N89-11868# Illinois Univ., Urbana. Dept. of Chemical Engineering.
EXPERIMENTAL AND THEORETICAL STUDY OF INCLUSIONS DURING INITIATION OF CREVICE CORROSION Ph.D. Thesis
Stephen Elder Lott 1987 101 p
(Contract DE-AC02-76ER-01198)
(DE88-014993; DOE/ER-01198/T24) Avail: NTIS HC A09/MF A01

The initiation sites of crevice corrosion on stainless steel are generally recognized to be sulfide inclusions (MnS), although the mechanism by which the initiation occurs remains unknown. Controlled solution experiments showed that the products of the MnS electrochemical oxidation reaction were elemental sulfur and thiosulfate. Spectroelectrochemical cell experiments on MnS quantified the electrochemical production of thiosulfate. This finding linked the metallurgical and solution phases and suggested a depassivation mechanism based on a critical crevice solution composition. The range of thiosulfate and chloride ion concentrations in which the stainless steel oxide film remained passive was determined. All other species present in the crevice were shown not to influence depassivation. From the proposed mechanism a mathematical model was developed to determine the position and time of breakdown in the crevice based on transport of species by migration and diffusion, electrochemical kinetics, and potential field theory. Instrumented artificial crevices cell experiments were conducted to test the validity of the model and the proposed mechanism. The crevice cell geometry had a variable crevice height of 2.7 to 9.2 + or - 0.2 micron and a depth of 1.27 cm; very good agreement between the experiments and the model was found for the conditions for avoiding crevice corrosion. The model was inverted in order to suggest the design criteria for achieving corrosion free crevices. DOE

N89-11869# Lawrence Livermore National Lab., Calif.
NUCLEATION AND GROWTH IN SURFACE MELTED ALLOYS
E. N. Kaufmann, J. S. Huang, A. M. Karo, M. A. Wall, and T. M. DeBoni Jul. 1988 12 p Presented at the MRS International Meeting on Advanced Materials, Tokyo, Japan, 30 May 1988

(Contract W-7405-eng-48)
(DE88-015443; UCRL-97716; CONF-880529-4) Avail: NTIS HC A03/MF A01

Rapid surface melting and solidification data is presented and a microscopic simulation is described. Examples are Cr-Ta, FeNiPB metallic glass, Ta-Ir, Cu-Z. DOE

N89-11870# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF HEAT TREATMENT AND CYCLIC STRAIN AMPLITUDE ON THE DAMPING PROPERTIES OF IRON-CHROMIUM BASED ALLOYS M.S. Thesis
James L. Childs, Jr. Jun. 1988 66 p
(AD-A197505) Avail: NTIS HC A04/MF A01 CSCL 11F

Fe-Cr-Al and Fe-Cr-Mo alloys are being studied for their high damping characteristics and possible utility to the Navy in the noise reduction and vibration control of shipboard machinery systems. This research studied the dependence of damping in these alloys on heat treatment and cyclic strain amplitude. Tensile specimens annealed at 900C and 1100C were subjected to cyclic axial loading at low strain levels on an MTS mechanical testing system, generating load-displacement hysteresis loops at various frequencies. These hysteresis loops were analyzed to determine the damping response at various levels of loading. Damping capacity is found to be dependent on both strain amplitude and frequency. A comparison is made between these results and previous work which evaluated the strain dependence of damping in these alloys using more conventional experimental methods. GRA

N89-11871# Virginia Univ., Charlottesville. Dept. of Materials Science.
THE INVESTIGATION OF THE FRACTURE OF TITANIUM ALLOYS BY IN-SITU AND ANALYTICAL MICROSTRUCTURAL TECHNIQUES Final Technical Report, 1 Mar. 1982 - 28 Feb. 1988
Heinz G. Wilsdorf Jun. 1988 142 p
(Contract N00014-82-K-0309)
(AD-A197514; UVA/525375/MS88/103) Avail: NTIS HC A07/MF A01 CSCL 11F

To study the effects of microstructures on crack propagation in titanium and titanium alloys was the prime objective of this project. The initial phase consisted of producing and characterizing microstructures in Ti-8Mn and in Ti-10V-2Fe-3Al. Other preliminary work was concerned with a determination of void initiation sites in C.P. titanium. The discovery that fracture surfaces exhibited limited areas with unusual dimple features, interpreted to have been caused by high temperatures, led to research on the temperature rise of moving crack tips. Experimentally, this entailed mechanical measurements using strain rates, the determination of stress intensity rates, straining in vacuum, measurement of fracture topographies by stereophotogrammetry, and the recording of light emission during fracture. GRA

N89-11872# Army Lab. Command, Watertown, Mass. Material Technology Lab.
BALLISTIC INTEGRITY OF STUD WELDS Final Report
William S. Ricci, William L. Crenshaw, James E. Catalano, and Attilio Santoro Jun. 1988 19 p
(AD-A197571; MTL-TR-88-19) Avail: NTIS HC A03/MF A01 CSCL 11F

Stud welds were fabricated in standard and ultrahigh strength armor steels. Bend, torque, tensile impact and ballistic impact tests were performed. Results from arc welded fasteners and stud welded hollow fasteners are compared with those from conventional stud welds. It was determined that the shock waves resulting from direct ballistic impact will cause failure of small welded fasteners regardless of the welding process employed. Factors influencing ballistic performance and methods of minimizing secondary projectile action are also presented. GRA

N89-11873# Argonne National Lab., Ill.
HYDROGEN-FREE ELECTRODEPOSITION OF CADMIUM COATINGS ON HIGH-STRENGTH STEEL FOR CORROSION PROTECTION Final Report
R. Varma, T. Hoeller, and H. Shimotake 29 Feb. 1988 110 p
(AD-A197711; NADC-88065-60) Avail: NTIS HC A06/MF A01 CSCL 11C

A raw method of electroplating cadmium onto high-strength steel has been developed at Argonne National Laboratory. The method has three aspects: (1) high-rate electrodeposition by pulsed currents in a flow cell that uses a flowing electrolyte; (2) an optimized pulse-nucleation step, followed by pulse or DC current growth of the electrodeposit; and (3) the use of aqueous fluoborate electrolyte. The electrolyte flow/pulse-plating method with aqueous fluoborate provides a unique approach for high-speed, hydrogen-free cadmium plating of steel in engineering shapes and sizes. A second method, which is based on electrodeposition from a molten salt, has also been investigated and shows promise as yet another hydrogen-free cadmium-plating technique. GRA

N89-11874# Centre Technique des Industries Mecaniques, Nantes (France).
INFLUENCE OF THE PRESENT HOT-SHRINK FORMING METHOD ON THE MECHANICAL PROPERTIES OF PLATES 5 TO 15 mm THICK Final Report [INFLUENCE DE LA PRATIQUE ACTUELLE DES CHAUDES DE RETRAIT SUR LES PROPRIETES MECANIQUES DE TOLES D'EPAISSEURS 5 A 15 MM]
R. Gaillard, P. Lemoine, P. Mahe, and F. Maltrud (Institut de Soudure, Paris, France) 21 Jul. 1988 67 p In FRENCH
(Contract CETIM-86-3191A)
(CETIM-104-320; CETIM-RT-22-328; ETN-88-93299) Copyright Avail: NTIS HC A04/MF A01

A theoretical and experimental study of the consequences of hot-shrinking plate straightening was performed. Flame heating and induction heating were considered. The steel plate specimens were 5 to 15 mm thick. The evolution of the metallurgical and mechanical properties (hardness, tensile strength, toughness) is not significant for either heating procedure. ESA

N89-11875# Centre Technique des Industries Mecaniques, Senlis (France).
INDUSTRIAL CHROME PLATING TESTS 1986 CAMPAIGN Final Report [ESSAIS INDUSTRIELS CHROMAGE, CAMPAGNE 1986]
Sutter, Vasseur, and Reby Dec. 1987 34 p In FRENCH
(CETIM-106280; ETN-88-93302) Copyright Avail: NTIS HC A03/MF A01

The parameters controlling the characteristics of chrome plating deposits in laboratory and full size industrial facilities were explored. The parameters studied included preliminary surface finishing procedures and operation process specifications. The study of surface finishing parameters shows that increasing the degreasing time affects significantly the corrosion resistance. Thermal shock tests indicate a large influence of the current density profiles. ESA

N89-11876# Centre Technique des Industries Mecaniques, Senlis (France).
COMMERCIALIZATION OF SMALL COMPUTER PROGRAMS ON HEAT TREATMENTS Final Report [COMMERCIALISATION DE PETITS LOGICIELS EN TRAITEMENT THERMIQUE]
D. Ghiglione, C. Tournier, and F. Convert Jul. 1988 45 p In FRENCH
(CETIM-106950; ETN-88-93305) Copyright Avail: NTIS HC A03/MF A01

The computer programs PROCALC and PATMOS are described: PROCALC calculates the carbon profile given the carburizing parameters; and PATMOS calculates the gaseous atmosphere components out of the nitrogen dilution of the cracking products of methanol or other chemical compounds of general formula CxHyOz. The programs were developed on the microcomputer

Sharp PC 1350 and are written in Sharp BASIC. The complete listings are presented. ESA

N89-11877# Centre Technique des Industries Mecaniques, Senlis (France).
INFLUENCE OF RESIDUAL STRESS IN SHOT PEENING ON TORSION FATIGUE Final Report [INFLUENCE DES CONTRAINTES RESIDUELLES DE GRENAILLAGE SUR LA RESISTANCE EN FATIGUE EN TORSION]
He Jiawen, Wu Yusheng, Yu Yonghe (Xian Jiaotong Univ., China), and J. F. Flavenot Mar. 1988 10 p In FRENCH
(CETIM-100750; ETN-88-93307) Copyright Avail: NTIS HC A02/MF A01

Different combinations of prestraining and peening were examined. The torsion fatigue curves obtained are presented. Ground specimens were also tested for comparison. The shot peened and then prestrained specimens show fairly large scatter for fatigue test data. The hardened distribution through the depth is thinner for short peened then prestrained specimen. All specimens fractured near the fatigue limit levels exhibit inclined crack paths 45 deg to the axial direction. ESA

N89-11878# Centre Technique des Industries Mecaniques, Senlis (France).
IONIC NITRIDING OF CASTS Final Report [NITRURATION IONIQUE DES FONTES]
J. Mongis, J. P. Peyre, J. J. Tessier, and C. Tournier Jun. 1987 102 p In FRENCH
(CETIM-12-M-010; ETN-88-93310) Copyright Avail: NTIS HC A06/MF A01

The nitriding kinetics and the mechanical properties of nitrided cast alloys are studied on graphite spheroidal and gray casts. Nitriding was performed in a standard nitrogen-hydrogen gas mixture. The results show that the hardening of the diffusion zone is weak if the cast does not contain alloying elements (Cr, Al, Va, Ti). Optimized-composition nitrided casts can be used as mechanical structural elements. ESA

N89-11879# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
[ACTIVITIES REPORT OF THE PERMANENT COMMITTEE TO THE GENERAL COUNCIL] Annual Report, 1987 [RAPPORT ANNUEL DU COMITE PERMANENT AU CONSEIL GENERAL]
22 Jun. 1988 65 p In FRENCH
(ISSN-0524-7705; ETN-88-93536) Avail: NTIS HC A04/MF A01

Casting, design of metallic structures, pressure vessels, heat treatments, refractory materials, mechanical design, automatic procedures and robots, plastic materials, surface treatment, and regional planning are discussed. ESA

N89-11880# Royal Aerospace Establishment, Farnborough (England).
VARIABLE AMPLITUDE FATIGUE CRACK GROWTH IN TITANIUM ALLOY Ti-4Al-4Mo-2Sn-0.5Si (IMI 550)
C. M. Ward-Close and R. O. Ritchie Mar. 1988 9 p
(RAE-Memo-Mat/STR-1103; BR106577; ETN-88-93561)
Copyright Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

Fatigue crack growth behavior in the alpha/Beta titanium alloy Ti-4Al-4Mo-2Sn-0.5Si (IMI 550), subject to single tensile overloads and the FALSTAFF flight simulation loading spectrum was studied. Fatigue overloads produce crack growth rate acceleration, followed by delayed retardation. The transient changes in crack growth rates are associated with large changes in crack closure immediately behind the crack tip. For single overloads and flight simulation loading, the greatest load-interaction effects are at the lowest load amplitudes. Microstructures has only a slight influence on load-interaction effects associated with single tensile overloads. However, at the higher stress amplitudes, the Beta annealed material shows greater retardation than the alpha/Beta material under simulated flight loading. ESA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials.*

N89-11881# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. JAPAN
12 Apr. 1988 119 p Transl. into ENGLISH from various Japanese articles
(JPRS-JST-88-003) Avail: NTIS HC A06/MF A01

Topics addressed include: telecommunications; metallurgical products; defense industries; and advanced materials. For individual titles, see N89-11882 through N89-11883.

N89-11882# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF OPTICAL ISOLATOR MATERIALS, APPLICATIONS **c74**
Katsumi Machida, Kazuhiro Nakajima, and Haruo Ishikawa *In its* JPRS Report: Science and Technology. Japan 12 Apr. 1988 p 1-17 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Oct. 1987 p 13-20 (For primary document see N89-11881 03-27)
Avail: NTIS HC A06/MF A01

Compact, low-priced, highly reliable optical isolators to be used to cut off the light rays reflected back to the light sources of optical communication or optical measurement systems are in demand today. Sumitomo Metal Mining Co. has developed magnetic garnet thick films as materials for Faraday rotors, which are the main components of optical isolators, using the liquid-phase epitaxial growth method. The development and applications of the materials are described. Author

N89-11883# Joint Publications Research Service, Arlington, Va.
DESIGN OF FUNCTIONALLY GRADIENT MATERIAL EXAMINED
Masayuki Niino *In its* JPRS Report: Science and Technology. Japan 12 Apr. 1988 p 18-46 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Oct. 1987 p 31-43 (For primary document see N89-11881 03-27)
Avail: NTIS HC A06/MF A01

Ultraheat-resistant materical technology is among the fundamental technologies on which whether next-generation space and aeronautical vehicles and fusion reactors can be successfully developed depends. Against the background of conventional methods for development of heat resistant materials, a concept of technical design intended to enable microstructural material elements to be controlled multidimensionally and continuously beginning from the material production stage is proposed and discussed. B.G.

N89-11884 Washington Univ., Seattle.
CERAMIC CRACK GROWTH RESISTANCE DETERMINATION UTILIZING LASER INTERFEROMETRY Ph.D. Thesis
Michael Gregory Jenkins 1987 222 p
Avail: Univ. Microfilms Order No. DA8802258

A testing procedure was developed to measure and quantify stable crack growth in structural ceramic materials at elevated temperatures. The testing method involves the measurement of the instantaneous specimen compliance for the calculation of the correponding effective crack length during stable crack growth in fracture tests. Resistance to fracture is then calculated at the effective crack length using energy methods and numerical solutions. The experimental procedure utilizes a non-contacting laser interferometric strain gage (LISG) to record the crack mouth opening displacement (CMOD) with a resolution of 0.25 micrometer. Excellent performance of the LISG for measuring displacements is demonstrated to testing temperatures of 1200 C. Chevron-notched and straight-notched three point bend specimens were used to study quasi-static, stable crack growth under displacement controlled conditions. Dissert. Abstr.

N89-11885# Virginia Transportation Research Council, Charlottesville.

USE OF ADMIXTURES TO ATTAIN LOW PERMEABILITY CONCRETES Final Report, Mar. 1986 - Dec. 1987

C. Ozyildirim and W. J. Halstead Feb. 1988 42 p Sponsored by Federal Highway Administration, Richmond, Va. and Virginia Dept. of Transportation, Richmond
(PB88-201264; VTRC-88-R11) Avail: NTIS HC A03/MF A01 CSCL 11C

The effects of two pozzolanic admixtures, fly ash and silica fume, and a ground-granulated blast furnace slag on the chloride ion intrusion of concretes prepared with low water-to-cementitious material ratios were investigated. Results of the rapid permeability tests (AASHTO T 277) showed that the resistance of concrete to the penetration of chloride ions increases significantly as the w/c is decreased for the same proportion of solid ingredients. Usually, concretes with pozzolans or slag exhibited higher resistance to chloride ion penetration than the control concretes containing portland cement as the cementitious material. Results of the 90 day ponding test (similar to AASHTO T 259), which was conducted with 0.40 w/c concretes only, indicated minimal chloride content at depths below 3/4 in (19 mm) for all the test concretes. Strength values for all concretes made with the pozzolans and slag at 90 days were in excess of 5,000 psi which is satisfactory. GRA

N89-11886# Army Belvoir Research and Development Center, Fort Belvoir, Va. Materials Fuels and Lubricants Lab.

EVALUATION OF COATED FABRICS FOR PNEUMATIC EQUIPMENT Final Report, Apr. 1987 - Apr. 1988

Paul E. Gatza, Dawn M. Crawford, and Brian J. David Jun. 1988 21 p
(AD-A196453; BRDEC-2470) Avail: NTIS HC A03/MF A01 CSCL 11J

This report details the scope of work and results obtained in a program to evaluate the performance characteristics of typical commercial elastomer coated fabrics used to fabricate inflatable boats, such as those currently cited in MIL-B-53067 for 3-, 7-, and 15-person sizes. Comparison of the material test data with the criteria cited in the new combined specification indicates that conformance is attainable. Likewise, in-house evaluation of performance of seams constructed from the candidate fabrics was generally acceptable. GRA

N89-11887# General Electric Co., Schenectady, N.Y. Corporate Research and Development.

ADVANCED ARTIFICIAL DIELECTRIC MATERIALS FOR MILLIMETER WAVELENGTH APPLICATIONS, PART A Annual Technical Report, 1 Oct. 1985 - 30 Jun. 1987

Israel S. Jacobs 1 Apr. 1988 37 p
(Contract N00014-83-C-0447; Proj. RR0-2202)
(AD-A196470; Rept-88-SRD-007) Avail: NTIS HC A03/MF A01 CSCL 20C

Described is research on non-magnetic composite artificial dielectrics. The electromagnetic evaluation of polymer-based composites was improved in the region of 2 to 18 GHz and extended to include Ka (26 to 40 GHz) and W (75 to 110 GHz) bands, through cooperation at NRL. Permittivity variations with frequency were essentially negligible. Induced permeability results were significant and were consistent with calculated models and data of earlier parts of this program. Previous results for permittivity versus volume loading were reinforced. The effect of binder permittivity was studied using an alternative inorganic binder. Qualitatively similar results were found, which scaled reasonably well to the binder permittivity as predicted. The permittivity behavior versus volume loading for randomly packed artificial dielectrics was modeled empirically from several ideal experiments and theoretically from a simplified model yields a satisfactory predictive control in considering the properties of such artificial dielectric materials. GRA

N89-11888# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.

DEFORMATION BEHAVIOR OF ISOTACTIC POLYSTYRENE Technical Report No. 3, 1987 - 1988

Julie K. Anderson, Robert E. Cohen, and Ali S. Argon 1 Apr. 1988 15 p
(Contract N00014-86-K-0768)
(AD-A196530) Avail: NTIS HC A03/MF A01 CSCL 07C

The deformation behavior of a model semicrystalline polymer with a well known rhombohedral crystal structure has been examined. As a direct consequence of its slow crystallization rate, isotactic polystyrene, the stereoregular analog of atactic polystyrene, may be prepared as an amorphous glass or as a semicrystalline polymer with a desired morphology. Study of the crystal structure prior to and following uniaxial compression is accomplished through the use of a microdiffractometer, with a beam size small enough to permit examination of different regions of the deformed cylinder. Changes in both the mechanical deformation behavior and the crystalline scattering pattern have been examined to elucidate the effects of the crystalline component of isotactic polystyrene upon the overall properties of the polymer. GRA

N89-11889# Massachusetts Inst. of Tech., Cambridge.

PLASTIC FLOW IN ORIENTED GLASSY POLYMERS Technical Report No. 2, 15 Jan. 1987 - 30 Jun. 1988

Mary C. Boyce, David M. Parks, and Ali S. Argon Oct. 1987 44 p
(Contract N00014-86-K-0768; DA Proj. A40-0005)
(AD-A196531) Avail: NTIS HC A03/MF A01 CSCL 07F

A manufactured product often possesses residual texture which was either incidentally or deliberately acquired during its processing history. This is particularly true for the case of polymers, where the ability to easily preferentially pre-orient the material in specific directions is exploited in order to obtain a higher strength product. Specific examples include synthetic fibers, and biaxially-oriented films and containers. The response of the pre-oriented/textured product to normal service life loading conditions will differ considerably from that of a product composed of isotropic material. This paper addresses the issue of the effects of texture on the deformation behavior of glassy polymers. Here, the physically-based constitutive model of Boyce, Parks, and Argon (1987) describing the rate, temperature, and pressure dependent inelastic deformation of initially isotropic glassy polymers is extended to include effects of pre-orientation, i.e., initial texture, via the use of appropriate initial conditions on internal state variables. GRA

N89-11890# Iowa State Univ. of Science and Technology, Ames. Dept. of Materials Science and Engineering.

PREPARATION AND MECHANISM OF FORMATION OF SPHERICAL SUBMICRON ZnS POWDERS Technical Report No. 1

Ahmet Celikkaya and Mufit Akinc 24 Jun. 1988 31 p
(Contract N00014-87-K-0738)
(AD-A196622) Avail: NTIS HC A03/MF A01 CSCL 07A

Zinc sulfide is an attractive infrared window material as it possesses good IR transmittance in the 8 to 12 micrometer range as well as high melting temperature. When a polycrystalline material is used for applications such as this, a uniform final microstructure is needed. Spherical, submicron particles of zinc sulfide were homogeneously precipitated by thermal decomposition of thioacetamide in acidic aqueous solutions. Rate of sulfide ion generation, determined by various combinations of temperature, pH, and initial concentrations of zinc ions and of thioacetamide, as related to particle growth rate had the paramount effect on the particle size distribution. Monosized, bimodal or narrow size distribution powders were obtained under certain combinations of experimental variables. Particles were found to be porous agglomerates of approx. 10 nm sphalerite crystallites. Particle growth was determined to proceed through diffusion-controlled aggregation of crystallites. GRA

N89-11891# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Chemistry.
MODIFICATIONS OF WELL DEFINED POLYSILANES Technical Report No. 5, Aug. 1987 - Jul. 1988
Krzysztof Matyjaszewski 15 Jul. 1988 22 p
(Contract N00014-87-K-0116)
(AD-A196672) Avail: NTIS HC A03/MF A01 CSCL 07F

Different homo and copolysilanes are prepared using sonochemical reductive coupling of disubstituted dichlorosilanes with sodium. Polymers formed in the presence of ultrasound are monomodal and can have polydispersity as low as M sub w/M sub n less than 1.2. Polysilanes containing aryl groups are dearylated upon treatment with strong protonic acids such as triflic acid. The resulting triflated polysilanes react readily with different nucleophiles providing alkoxy and amino substituted polysilanes. Triflated polymers react with monomers which can be polymerized cationically and form graft copolymers. GRA

N89-11892# California Univ., Santa Barbara. Dept. of Chemistry.
SOLID-STATE 29SI NMR AND INFRARED STUDIES OF THE REACTIONS OF MONO- AND POLYFUNCTIONAL SILANES WITH ZEOLITE SURFACES Technical Report No. 3
Thomas Bein, Robert F. Carver, Rodney D. Farlee, and Galen D. Stucky May 1988 68 p Prepared in cooperation with New Mexico Univ., Albuquerque, Dept. of Chemistry and E. I. du Pont de Nemours and Co., Wilmington, Del.
(Contract N00014-87-K-0457)
(AD-A196737) Avail: NTIS HC A04/MF A01 CSCL 07C

The combined use of 29Si magic-angle spinning nuclear magnetic resonance (NMR) spectroscopy and in situ infrared techniques allows for the first time the determination of the intrazeolitic reaction products and details of the interaction of various silanes with zeolitic protons. Alkoxy groups at Me3SiOMe and MeSi(OMe)3 are readily lost to form hydroxy groups and then siloxane bridges to the zeolite framework. At elevated temperatures, alkyl groups are also split off from the silane, and more highly substituted siloxane species are generated which are anchored to the framework via two siloxane bridges. Chloro groups are rapidly hydrolyzed by the surface hydroxy groups, and the resulting products follow the reaction pattern of the alkoxysilanes. GRA

N89-11893# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
SYNTHESIS OF NONCRYSTALLINE AROMATIC POLYAMIDES Final Report, Jan. 1985 - Jan. 1986
Tonson Abraham, E. J. Soloski, and R. C. Evers Apr. 1988 19 p Prepared in cooperation with Dayton Univ., Ohio
(AD-A196745; AFWAL-TR-88-4105) Avail: NTIS HC A03/MF A01 CSCL 11I

Noncrystalline thermooxidatively stable aromatic polyamides were synthesized through the triphenyl phosphite-promoted polycondensations of 3,3-(sulfonylbis(1,4-phenylenoxy)) dibenzoic acid and 3,3(carbonylbis(1,4-phenylenoxy)) dibenzoic acid with 3,3-(1,3-phenylendioxy)dianiline. Alternatively, the polymers could be prepared through the low temperature polydensations in N-methylpyrollidone of the corresponding diacid chlorides with the aromatic diamine. An additional polyamide was synthesized through the self-condensation of 3-(4-(3-aminophenoxybenzoyl) phenoxy) benzoic acid. This previously unreported monomer had been prepared by a two-step reaction sequence from 4,4-difluorobenzophenone. Inherent viscosities in the range of 0.27 to 0.63 dl/g (N,N-dimethylacetamide, 30C, 0.2 g/dl) were obtained. Polymer structures were established by elemental analyses and infrared spectroscopy. Thermal characterization was carried out by differential scanning colorimetry, thermal gravimetric analysis, and isothermal aging. GRA

N89-11894# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
POLYARAMIDES WITH REACTIVE PHENYLETHYNYL PENDANTS Final Report, Jul. 1983 - Jul. 1986
Robert C. Evers, George J. Moore, and Tonson Abraham Apr. 1988 32 p
(AD-A196746; AFWAL-TR-88-4106) Avail: NTIS HC A03/MF A01 CSCL 07C

2,5-Bis(phenylethynyl)terephthaloyl chloride and 4,6-bis(phenylethynyl)isophthaloyl chloride were synthesized in a multistep reaction scheme from 2,5-dibromoterephthaldehyde and 4,6-dibromoisophtahldehyde, respectively. Low temperature solution polycondensation of these novel monomers and tolane-2,4'-dicarbonyl chloride with aromatic diamines yielded polyaramides containing phenylethynyl moieties. Inherent viscosities of 0.20 to 0.51 dl/g were recorded. Attempts to carry out the homopolymerization of 2-(3-aminophenylethynyl)-benzoyl chloride hydrochloride under similar conditions led to low molecular weight polyamide. Under differential scanning calorimetry and thermal mechanical analysis, the polyamides exhibited strong exotherms with onset occurring in the 185 to 225 C range. The exotherms were attributable to intramolecular cycloaddition of phenylethynyl moieties with amide groups to give polybenzalphthalimidine structures. Curing of a pressed pellet specimen for 16 hours at 250 C under a nitrogen atmosphere resulted in partial conversion to a polybenzalphthalimidine structure with a concomitant increase in the polymer glass transition temperature. GRA

N89-11895# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
PYROLYSIS-GAS CHROMATOGRAPHY/MASS SPECTROMETRY OF THERMOPLASTIC POLYMERS Technical Memorandum Report
J. A. Hiltz and M. C. Bissonnette Apr. 1988 55 p
(AD-A196842; DREA-TM-88/209) Avail: NTIS HC A04/MF A01 CSCL 07F

Thermal degradation mechanisms of ten thermoplastic polymers have been investigated using pyrolysis-gas chromatography with mass spectrometric and flame ionization detection. The results indicate that an unknown plastic can be identified on the basis of its degradation products and that interpretation of the degradation product analysis can be used to predict thermal degradation mechanisms and chemical structures of polymers. Identification of thermal degradation products gives insight into the hazards involved with these materials in the presence of heat and flame. Pyrograms of ten thermoplastic polymers including polyethylene (HiFaxTM), polymethylmethacrylate (PlexiGlasTM), polyphenylene either (PrevexTM), polyacetal (DelrinTM), polyamide (Nylon 6,6TM), polyphenylene sulfide, polyvinylchloride (BoltaronTM), polyimide (SolimideTM), polyamideimide (TorlonTM), and polyetheretherketone (VictrexTMPEEK) obtained at 800 C and 1000 C with both flame ionization detection and quadropole mass spectrometric detection are included. GRA

N89-11896# Howard Univ., Washington, D. C. Dept. of Chemistry.
THE 413 - IR REFLECTANCE AND RAMAN SCATTERING OF DIAMOND FILMS Annual Technical Report No. 1, 1 Mar. 1987 - 28 Feb. 1988
George E. Walrafen 28 Feb. 1988 34 p
(Contract N00014-87-K-0109)
(AD-A196905) Avail: NTIS HC A03/MF A01 CSCL 07B

The investigative work has involved analysis and interpretation of the features seen from the diamond films supplied by various workers. From the various diamond films, three general types of peaks were seen. These correspond to peak frequencies of 1330/cm (a very sharp peak), ca. 1350/cm (a very broad peak), and ca. 1600/cm (a broad and sometimes structured contour). To understand these three classes of peaks we obtained Raman spectra from bulk crystalline diamond, from various graphites, and from a wide range of amorphous carbons. The data and tentative interpretation are presented. GRA

N89-11897# Pennsylvania State Univ., University Park.
NEW CONDUCTING POLYMERS Report, for 1 Aug. 1987 - 30 Jun. 1988

Bernard Gordon, III, James P. Runt, and Paul C. Painter 30 Jun. 1988 6 p
(Contract N00014-85-K-0899)
(AD-A197009) Avail: NTIS HC A02/MF A01 CSCL 07F

Conducting polymers, in the n-doped state, have the proposed structure of totally delocalized carbanions. These are produced by the reduction of totally conjugated polymers. An alternative route to polymeric delocalized carbanions is through proton abstraction from methylenes which are doubly allylic and/or benzylic and placed periodically along the polymer backbone. Polymers, oligomers and model compounds of this general type are currently being prepared. Proton abstraction is being carried out with strong base. To stabilize the delocalized carbanion we are preparing monomers and model compounds which contain strong electron withdrawing groups to study the effect of stabilization on conductivity. To prepare high molecular weight materials, we are preparing non-conducting segments to polymerize with the above conducting segments. These materials should have higher stability and more useful properties which can be tailored by composition of the resulting block copolymer. GRA

N89-11898# Sandia National Labs., Albuquerque, N. Mex. Ceramics Development Div.
STRUCTURE AND GROWTH OF SILICA CONDENSATION POLYMERS
Keith D. Keefer 1987 24 p Presented at the American Chemical Society Meeting, Honolulu, Hawaii, 21 Nov. 1987
(Contract DE-AC04-76DP-00789)
(DE88-012959; SAND-87-2313C; CONF-8711207-1) Avail: NTIS HC A03/MF A01

Inorganic silicate polymers are prepared by the hydrolysis of silicon alkoxides and subsequent condensation of the resulting silanols. The structures can be described only in a statistical fashion by means of fractal geometry. The structures are controlled by the relative rates of the hydrolysis reactions which generate reactive silanol groups and the condensation reactions of those groups. Under alkaline conditions, hydrolysis tends to be slow with respect to condensation, and non-fractal colloidal structures form by a nucleation and reaction limited growth process. Under acidic condition, hydrolysis tends to be fast with respect to condensation, and polymeric fractal structures with D(sub f) = 2.1 are formed by reaction limited cluster aggregation. The exact structure in real systems may only approach these idealized cases. DOE

N89-11899# Illinois Univ., Urbana. Dept. of Materials Science and Engineering.
RECENT DEVELOPMENTS IN THE CHEMICAL PROCESSING OF ELECTRICAL CERAMICS
David A. Payne 1988 4 p Presented at the International Forum on Fine Ceramics: Fine Ceramics for the Future, Nagoya, Japan, 1 Mar. 1988
(Contract DE-AC02-76ER-01198)
(DE88-014171; CONF-8803139-1) Avail: NTIS HC A02/MF A01

A variety of chemical methods of ceramic processing have been developed, which include solution liquid-mix methods, co-precipitation, and sol-gel processing. This paper reports on, the (1) precipitation of colloidal particles by controlled nucleation and growth processes, for the preparation of powders with uniform composition and controlled morphology, which are used in thick-film capacitors; (2) an alternate chemical processing route, known as polymeric mixed-alkoxide processing, which avoids powder, for the spin-casting of thin-layer devices on semiconductors; (3) the feasibility of coating colloidal particles with alkoxide coatings for the chemical bonding of ceramics at reduced temperatures; and (4) a liquid solution resin forming process, known as the Pechini method, for the preparation of superconducting ceramics. DOE

N89-11900# Texas A&M Univ., College Station. Mechanics and Materials Center.
ON THE MECHANICS OF CRACK CLOSING AND BONDING IN LINEAR VISCOELASTIC MEDIA
R. A. Schapery Jul. 1988 49 p
(Contract N00014-86-K-0298)
(AD-A197500; AD-E501007; MM-5488-88-6) Avail: NTIS HC A03/MF A01 CSCL 11D

The mechanics of quasi-static crack closing and bonding of surfaces of the same or different linear viscoelastic materials is described. Included is a study of time-dependent joining of initially curved surfaces under the action of surface forces of attraction and external loading. Emphasis in on the use of continuum mechanics to develop equations for predicting crack length or contact size as a function of time for relatively general geometries; atomic and molecular processes associated with the healing or bonding process are taken into account using a crack tip idealization which is similar to that used in the Barenblatt method for fracture. Starting with a previously developed correspondence principle, an expression is derived for the rate of movement of the edge of the bonded area. The effects of material time-dependence and the stress intensity factor are quite different from those for crack growth. A comparison of intrinsic and apparent energies of fracture and bonding is made, and criteria are given for determining whether or not bonding can occur. Examples are given to illustrate use of the basic theory for predicting healing for cracks and growth of contact area of initially curved surfaces. Finally, the affect of bonding time on joint strength is estimated from the examples on contact area growth. GRA

N89-11901# Connecticut Univ., Storrs. Liquid Crystalline Polymer Research Center.
SYNTHESIS AND CHARACTERIZATION OF THE LIQUID CRYSTALLINE SIDE CHAIN POLYMER 4'-CYANO-4-PENTYLOXYSTILBENE POLYSILOXANE Interim Technical Report No. 12
Girija Subramaniam and R. K. Gilpin 22 Jul. 1988 30 p Prepared in cooperation with Kent State Univ., Ohio
(Contract N00014-86-K-0772)
(AD-A197577) Avail: NTIS HC A03/MF A01 CSCL 07C

The liquid crystalline side chain polymer 4'-cyano-4-pentyloxystilbene polysiloxane has been synthesized via direct condensation polymerization of the dichlorosilane monomer. Likewise, the synthesis of the starting silane, 4'-cyano-4(5-dichloromethylsilyl)pentyloxy stilbene which was used to terminate the reaction is reported. The mesogenic properties of the polymer, the side chain liquid crystal precursor and the respective dichlorosilane monomer are discussed. GRA

N89-11902# Connecticut Univ., Storrs. Liquid Crystalline Polymer Research Center.
X-RAY DIFFRACTION BY THERMOTROPIC MAIN-CHAIN POLYMERS HAVING SIDE GROUPS. PART C: SEMIFLEXIBLE POLYESTERS Technical Report No. 8
Hui H. Chin, Leonid V. Azaroff, Agya R. Saini, and Robert W. Lenz 13 Jul. 1988 23 p Prepared in cooperation with Massachusetts Univ., Amherst
(Contract N00014-86-K-0772)
(AD-A197607) Avail: NTIS HC A03/MF A01 CSCL 07F

It is possible to regain some of the tensile properties that are sacrificed when flexible spacers are inserted periodically in a rigid polymer chain by aligning the chains parallel to each other. One way to do this is to utilize the dipoles present on the anisometric monomers along the chain by placing the liquid-crystalline polymer (LCP) in a magnetic field. Because of their relatively high viscosity, alignment of LCP chains requires fairly strong magnetic fields. An alternative means of aligning the chains is provided by mechanical shear, either by drawing fibers or producing sheets, thus regaining some of the anisotropic mechanical properties of the LCPs themselves. The present study was undertaken to determine the molecular structure of semiflexible polyesters having comparable molecular structures to the more rigid LCPs discussed in Part B of this series by employing the relative intensities of all recordable X-ray reflections, as well as their disposition in reciprocal space. Semiflexible thermotropic aromatic polyesters with lateral groups were aligned magnetically and mechanically in monodomains after separation into high-molecular-weight (polymer) and low-molecular-weight (oligomer) fractions. Based on the total X-ray intensity distributions recorded for a series of seven different substituents in the arylsulfonyl substituted group, a novel smectic structure was determined for Hydrogen, Fluorine, Chlorine, Methoxyradical, and Methylradical in the para-position while a normal nematic alignment prevailed when it contained Br or NO2. GRA

N89-11903# Washington Univ., Seattle. Dept. of Materials Science and Engineering.

NEW CATALYTIC ROUTES TO PRECERAMIC POLYMERS: CERAMIC PRECURSORS TO SILICON NITRIDE AND SILICON-CARBIDE NITRIDE

Kay A. Youngdahl, Richard M. Laine, Richard A. Kennish, Terrence R. Cronin, and Gilbert G. Balavoine Aug. 1988 10 p
(Contract N00014-88-K-0305)
(AD-A197611; TR-14) Avail: NTIS HC A02/MF A01 CSCL 07F

Pyrolysis of a set of silicon and nitrogen substituted polysilazanes are conducted under a set of standard conditions (5 C/min to 900 C in a nitrogen atmosphere). The apparent ceramic compositions and ceramic yields for pyrolyzed samples of the polysilazanes (Ph(H)SiNH)x, (C6H13(H)SiNH)x, (Me(H)SiNH)x, and (H2SiNMe)x are determined. Preliminary conclusions concerning structure/reactivity relationships are discussed based on the pyrolysis results. GRA

N89-11904# University of Southern Mississippi, Hattiesburg. Dept. of Polymer Science.

NATURAL ABUNDANCE 15N CP/MAS NMR OF NYLONS. A SENSITIVE TECHNIQUE FOR EVALUATING CRYSTALLINE COMPOSITION AND CONFORMATION IN SOLID POLYAMIDES Technical Report, No. 10, Aug. 1987 - Jul. 1988

Lon J. Mathias, Douglas G. Powell, and Allison M. Sikes 15 Jul. 1988 7 p
(Contract N00014-86-K-0659)
(AD-A197617) Avail: NTIS HC A02/MF A01 CSCL 11I

Solid state nitrogen (nuclear magnetic resonance) NMR spectra (at nitrogen natural abundance) were obtained on several polyamides of previously-identified crystalline composition. Characteristic peaks were seen for amide units in alpha-crystalline domains at 83 to 85 ppm in ppm downfield from glycine. Peaks for the gamma-form domains were seen at 88 to 90 ppm. Most interesting was the appearance of additional peaks between these two peaks which apparently correspond to amide conformations in intermediate crystalline forms and/or amorphous regions. Initial results are consistent with peak intensities correlating well with crystal composition, suggesting that this may be a quantitative as well as qualitative method for determining crystallinity in nylons. GRA

N89-11905# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

THE PREPARATION OF SILICON-CONTAINING CERAMICS BY ORGANOSILICON POLYMER PYROLYSIS

Dietmar Seyferth 25 Jun. 1988 37 p
(Contract N00014-82-K-0322)
(AD-A197633; TR-25) Avail: NTIS HC A03/MF A01 CSCL 11B

Silicon-containing ceramics include the oxide materials, silica and silicates; the binary compounds of silicon with non-metals, principally silicon carbide and silicon nitride; silicon oxynitride and the sialons; main group and transition metal silicides, and, finally, elemental silicon itself. There is a vigorous research activity throughout the world on the preparation of all of these classes of solid silicon compounds by the newer preparative techniques. Silicon carbide SiC and silicon nitride Si3N4, have been known for some time. Their properties, especially their high thermal and chemical stability, their hardness, their high strength, as well as other properties have led to useful applications for both of these materials. The design of useful, (i.e., potentially commercializable) organosilicon preceramic polymers presents an interesting challenge to the synthetic chemist. We have attempted, using examples from some of our research, to convey some of the chemical considerations which we feel are important if such a synthesis is to be successful. Our initial experiment in this area, the reaction of ammonia with dichlorosilane, was carried out. Gary H. Wiseman developed the dehydrocyclodimerization route to useful preceramic polymers and widened our horizons into the fascinating area of ceramics. Dr. Timothy G. Wood studied the action of Methyldichlorosilane and carried out the first graft synthesis of the polysilazane/polysilane hydride polymer. GRA

N89-11906# Princeton Univ., N. J. Dept. of Chemical Engineering.

ANOMALOUS BEHAVIOR OF CURED EPOXY RESINS: DENSITY AT ROOM TEMPERATURE VERSUS TIME AND TEMPERATURE OF CURE Technical Report No. 15, 1 Jul. 1987 - 1 Jul. 1988

K. P. Pang and J. K. Gillham Jul. 1988 57 p
(Contract N00014-84-K-0021)
(AD-A197644) Avail: NTIS HC A04/MF A01 CSCL 11I

The room temperature density rho sub RT of a difunctional aromatic epoxy resin cured with a tetrafunctional aromatic amine passes through a maximum value with increasing conversion. For a given cooling rate cure results in a unique value of rho sub RT for each conversion as long as the material does not vitrify on cure. The occurrence of vitrification during cure eliminates the one-to-one relationship because of the non-equilibrium nature of the glass transition region and of the glassy state. In the glass transition region there is competition between physical aging which increases the density and chemical aging which decreases rho sub RT. Prolonged isothermal cure and physical aging to well beyond vitrification result in limiting values of rho sub RT which decrease with increasing temperature of cure. GRA

N89-11907# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).

MECHANICAL BEHAVIOR OF SILICON CARBIDE AND MULLITE ZIRCONIA AT HIGH TEMPERATURES Ph.D. Thesis [COMPORTEMENT MECANIQUE A HAUTE TEMPERATURE DES MATERIAUX CARBURE DE SILICIUM ET MULLITE ZIRCONE]

Farid Gheldane 1988 155 p In FRENCH; ENGLISH summary
(ITC1-88-02; ETN-88-93285) Avail: NTIS HC A08/MF A01

A covalent sintered material (SiC) and a reaction sintered composite containing a significant amount of a glassy phase (mullite-zirconia) are studied. The thermomechanical behavior of SiC materials is analyzed, and toughness is investigated by means of indentation tests, SENB, and chevron notched short rod methods. High temperature mechanical behavior is controlled by a residual boundary phase. The behavior of three batches of mullite-zirconia and mullite-alumina-zirconia materials is also investigated. The toughening contribution of zirconia particles is shown. ESA

N89-11908# Centre Technique des Industries Mecaniques, St. Etienne (France).

ADHESIVE BONDED ASSEMBLIES DESIGN. QUASIELASTIC ADHESIVES Final Report [CALCUL DES ASSEMBLAGES COLLES. ADHESIFS QUASI-ELASTIQUES. PROCES-VERBAL 47-632/F]

J. P. Jeandrau and J. N. Dewas Sep. 1987 84 p In FRENCH
(Contract DRET-84-34-494-00-470-75-01)
(CETIM-102660; Rept-47-632/F; ETN-88-93294) Copyright
Avail: NTIS HC A05/MF A01

The CASTOR finite element program was adapted to the problem of bonded assemblies design, after bibliographic analysis of assembly design methods and adhesive characterization methods. The experimental validation was performed using two structural adhesives at three temperatures. An extensometric device was developed to measure the bonded joints in the test assemblies. The validity of the Von Mises criterion is confirmed in the elastic domain of both adhesives. The experimental results show that the properties of the adhesive in a thin joint are similar to those measured on the bulk. ESA

N89-11909# Centre Technique des Industries Mecaniques, St. Etienne (France).
MODELING AND BEHAVIOR PREDICTION OF AN ADHESIVE BONDED ASSEMBLY (BEFORE AND AFTER AGING BY IMMERSION IN 70 C WATER) FROM THE BULK CHARACTERISTICS OF THE ADHESIVE Final Report [MODELISATION ET PREVISION DU COMPORTEMENT D'UN ASSEMBLAGE COLLE (AVANT ET APRES VIEILLISSEMENT EN IMMERSION DANS L'EAU A 70 C) A PARTIR DES CARACTERISTIQUES DE L'ADHESIF A L'ETAT MASSIQUE]
Jean-Pierre Jeandrau Apr. 1987 100 p In FRENCH
(Contract MRES-GIS-85-S-0917)
(CETIM-105040; ETN-88-93300) Copyright Avail: NTIS HC A05/MF A01

Laboratory tests were performed on the bulk adhesive and on bonded assemblies. The tests include compression, tensile, torque, with varying times of immersion in 70 C water. The assemblies were tested under shear (DIN 54451). The surfaces after fracture were observed using a scanning electron microscope. A reduction of the number of tests necessary to design bonded assemblies is possible. The models used are available as programs for PC microcomputers. ESA

N89-11910# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
OPERA PROJECT. VARNISHING AND BONDING OF THE SENSORS. ENGINEERING MODEL UNIT [PROGETTO OPERA VERNICIATURA E INCOLLAGGIO DEI SENSORI. UNITA MODELLO INGEGNERISTICO]
P. Baldetti Jul. 1988 37 p Partly in DUTCH; ENGLISH; and ITALIAN
(IFSI-88-8; ETN-88-93475) Avail: NTIS HC A03/MF A01

The procedures for varnishing and adhesive bonding of the OPERA (plasma waves and auroral radiation) experiment are described. The varnishing shop installation included a 50C oven, compressed air, washing and ventilation units. The bonding is done with epoxy adhesive. The specifications of the materials used are included. ESA

N89-11911*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNOLOGICAL HURDLES TO THE APPLICATION OF INTERCALATED GRAPHITE FIBERS
James R. Gaier Dec. 1988 16 p Presented at the Fall Meeting of the Materials Research Society, Boston, Mass., 28 Nov. - 2 Dec. 1988
(NASA-TM-101394; E-4469; NAS 1.15:101394) Avail: NTIS HC A03/MF A01 CSCL 11C

Before intercalated graphite fibers can be developed as an effective power material, there are several technological hurdles which must be overcome. These include the environmental stability, homogeneity and bulk properties, connection procedures, and costs. Strides were made within the last several years in stability and homogeneity of intercalated graphite fibers. Bulk properties and connection procedures are areas of active research now. Costs are still prohibitive for all but the most demanding applications. None of these problems, however, appear to be unsolvable, and their solution may result in wide spread GOC application. The development of a relatively simple technology application, such as EMI shielding, would stimulate the solution of scale-up problems. Once this technology is developed, then more demanding applications, such as power bus bars, may be possible. Author

N89-11912*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MOLTEN SALT CORROSION OF SIC AND SI3N4
Nathan S. Jacobson, James L. Smialek, and Dennis S. Fox Nov. 1988 68 p
(NASA-TM-101346; E-4370; NAS 1.15:101346) Avail: NTIS HC A04/MF A01 CSCL 11D

Industrial systems such as heat engines and heat exchangers involve harsh environments. The structural materials are subjected to high temperatures as well as corrosive gases and condensed phases. Past experience with metal alloys has shown that these condensed phases can be particularly corrosive and are often the limiting factor in the operation of these systems. In a heat engine the most common condensed corrodent is Na2SO4 whereas in a heat exchanger an oxide slag may be present. The primary emphasis is on Na2SO4 induced corrosion, however, similarities and differences to oxide slag are also discussed. The extensive research on corrosion of metal alloys has led to understanding and controlling corrosion for these materials. Currently silicon based ceramics are prime candidates for the applications discussed. Therefore it is important to understand the effects of condensed phase deposits on this emerging class of high temperature materials. Both the thermodynamic and strength of the ceramic is also examined. Finally some control strategies for corrosion of silicon based ceramics are explored. Author

N89-11913*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION, FRICTION, AND WEAR OF PLASMA-DEPOSITED THIN SILICON NITRIDE FILMS AT TEMPERATURES TO 700 C
K. Miyoshi, J. J. Pouch, S. A. Alterovitz, D. M. Pantic, and G. A. Johnson [1988] 12 p Prepared for presentation at the International Conference on Wear of Materials, Denver, Colo., 9-13 Apr. 1989. Sponsored by ASME Prepared in cooperation with Cincinnati Univ., Ohio
(NASA-TM-101377; E-4431; NAS 1.15:101377) Avail: NTIS HC A03/MF A01 CSCL 11C

The adhesion, friction, and wear behavior of silicon nitride films deposited by low- and high-frequency plasmas (30 kHz and 13.56 MHz) at various temperatures to 700 C in vacuum were examined. The results of the investigation indicated that the Si/N ratios were much greater for the films deposited at 13.56 MHz than for those deposited at 30 kHz. Amorphous silicon was present in both low- and high-frequency plasma-deposited silicon nitride films. However, more amorphous silicon occurred in the films deposited at 13.56 MHz than in those deposited at 30 kHz. Temperature significantly influenced adhesion, friction, and wear of the silicon nitride films. Wear occurred in the contact area at high temperature. The wear correlated with the increase in adhesion and friction for the low- and high-frequency plasma-deposited films above 600 and 500 C, respectively. The low- and high-frequency plasma-deposited thin silicon nitride films exhibited a capability for lubrication (low adhesion and friction) in vacuum at temperatures to 500 and 400 C, respectively. Author

N89-11914# Technische Hochschule, Darmstadt (West Germany). Fachbereich Physik.
INVESTIGATIONS OF THERMODYNAMIC, STRUCTURAL, CRYSTALLOGRAPHIC, AND MECHANICAL PROPERTIES OF MAIN RIGID CHAINED THERMOTROPE AND LIQUID CRYSTAL POLYMERS Ph.D. Thesis [UNTERSUCHUNGEN DER THERMODYNAMISCHEN, STRUKTURELLEN, KRISTALLOGRAPHISCHEN UND MECHANISCHEN EIGENSCHAFTEN VON STEIFKETTIGEN, THERMOTROPEN, FLUESSIGKRISTALLINEN HAUPTKETTENPOLYMEREN]
Hans-Juergen Zimmermann 1987 146 p In GERMAN
(ETN-88-93240) Avail: NTIS HC A07/MF A01

Thermodynamic, structural, and mechanical properties of liquid crystal polymers are analyzed. Chemical bond structures are investigated by X-ray analysis. Structure and mechanical property modifications by tempering are experimentally studied. Plastic structure modifications and crystallization phases are developed. ESA

N89-11915# Technical Research Centre of Finland, Espoo. Metals Lab.
TESTING REQUIREMENTS OF ENGINEERING CERAMICS
Pertti Auerkari, Kim Wallin, Pentti Kauppinen, Juha Kumpulainen, and Antero Siidorow Jul. 1988 33 p In FINNISH; ENGLISH summary Sponsored by the Technology Development Center (TEKES), Finland
(VTT-RR-538; ISBN-9-51-383197-3; ISSN-0358-5077;

ETN-88-93533) Copyright Avail: NTIS HC A03/MF A01; Technical Research Centre of Finland, Vuorimiehentie 5, SF-02150 Espoo, Finland 40 Finnish marks

Testing procedures are investigated in order to improve the accuracy of design methods for ceramic materials. The relation between strength and toughness of engineering ceramics is examined, studying their dependance on small defects included in the ceramic specimens. It is shown that the strength estimation for design purposes should be determined statistically, since considerable differences may exist between the average properties of the actual materials and the individual values from specimens. Nondestructive tests are of most advantage if toughness and design stresses are balanced to yield acceptable maximum defect sizes not below 0.1 mm. ESA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N89-11916# Weapons Systems Research Lab., Salisbury (Australia).

SYNTHESES AND CHARACTERISATIONS OF DERIVATIVES OF ETHYL CENTRALITE

N. J. Curtis Dec. 1987 34 p

(WSRL-0563-TR; AR-005-342) Avail: NTIS HC A03/MF A01

A comprehensive description is given of the preparations of all the major derivatives of ethyl Centralite found in nitrocellulose based propellants. These compounds are fully characterized by spectroscopic and thin-layer techniques. Author

N89-11917# Oak Ridge National Lab., Tenn.

SYNTHETIC AND ALTERNATE FUELS CHARACTERIZATION Final Report, 31 Aug. 1981 - 31 Jan. 1988

W. H. Griest, M. R. Guerin, L. H. Smith, H. P. Witschi, and C. E. Higgins 1 Feb. 1988 98 p Sponsored in part by Army

(AD-A197531; ORNL/TM-10706) Avail: NTIS HC A05/MF A01 CSCL 21D

Diesel fuels derived from petroleum and synthetic sources were compared chemically and toxicologically to address the issue of whether a changeover of mobility fuels from natural to synthetic sources might be accompanied by greater or different toxicological hazards to military personnel. Diesel fuels derived from petroleum, shale oil, tar sands, and tar sands/petroleum coprocessing were compared for major organic composition, 4 to 6 ring polycyclic aromatic hydrocarbon dermal tumorigens, major organic compounds in their inhalable volatiles, mouse dermal tumorigenicity and promoting activity. The database was expanded by a similar comparison of petroleum- and coal-derived fuels for the U.S. Department of Energy (USDOE). The results suggest that highly refined and finished mobility fuels from synthetic or alternate sources will not pose a significantly greater toxicological hazard than current petroleum-based fuels. Toxicological differences are likely to be subtle. GRA

N89-11918# Environmental Research Lab., Gulf Breeze, Fla.

ENVIRONMENTAL FATE AND EFFECTS OF SHALE-DERIVED JET FUEL Final Report, Oct. 1984 - Mar. 1986

P. H. Pritchard, T. P. Maziarz, L. H. Mueller, and A. W. Bourquin Jun. 1988 99 p

(AD-A197683; MIPR-N85-16; AFESC/ESL-TR-87-09) Avail: NTIS HC A05/MF A01 CSCL 21D

Tests were conducted to compare the environmental fate of shale oil-derived jet fuel with that of petroleum-derived jet fuel. These tests included chemical characterization of the fuels and the water-soluble fraction of each fuel, as well as measurement of volatilization and biodegradation rates in laboratory systems designed to simulate three disparate aquatic environments. No major differences in the volatilization and biodegradation rates of the two fuels were found. Differences in composition were generally small and should not cause the behavior of the fuels in aquatic environments to differ. GRA

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.

For biological materials see *55 Space Biology.*

N89-11919# Technische Hochschule, Aachen (West Germany). Giesserei Inst.

CONVECTION PROCESS AND THE SOLIDIFICATION FRONT: PREPARATION AND UTILIZATION OF A SPACELAB D1 EXPERIMENT Final Report

Stephan Rex and Peter R. Sahm Bonn, Fed. Republic of Germany BMFT Mar. 1987 104 p In GERMAN; ENGLISH summary Sponsored by BMFT

(ETN-88-93228) Avail: NTIS HC A06/MF A01

Gravity induced convection in metallic alloys was investigated with regard to its influence on segregation and solidification front stability by reference experiments under reduced gravity, in the case of thermosolutal convection in front of a plan solidification interphase with a binary AlMg alloy. During the D1 mission two rod-shaped specimens were directionally solidified and quenched in the multiuser facility MD-GFQ. The process parameters were choosen such that the plan front solidification was diffusion controlled only, contrary to the 1g-reference experiment under convective mixing conditions within the melt. The evaluation shows the successful performance of the D1-experiments. The identical concentration profiles along the two flight samples, evaluated by microprobe-analysis, correspond to the classical solidification theories of diffusion controlled crystallization besides a uniform but small loss of Mg from the melt. The 1g-reference sample shows a markedly enhanced variation of the composition pushed by convective mixing and a flat distribution of the Mg content along the crystallized length. ESA

N89-11920*# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.

AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF THERMOACOUSTIC CONVECTION HEAT TRANSFER IN GRAVITY AND ZERO-GRAVITY ENVIRONMENTS

Masood Parang Apr. 1986 185 p

(Grant NAG3-239)

(NASA-CR-179575; NAS 1.26:179575) Avail: NTIS HC A09/MF A01 CSCL 12A

An experimental and analytical study of Thermoacoustic Convection heat transfer in gravity and zero-gravity environments is presented. The experimental apparatus consisted of a cylinder containing air as a fluid. The side wall of the cylinder was insulated while the bottom wall was allowed to remain at the ambient temperature. The enclosed air was rapidly heated by the top surface which consisted of a thin stainless steel foil connected to a battery pack as the power source. Thermocouples were used to measure the transient temperature of the air on the axis of the cylinder. The ouput of the thermocouples was displayed on digital thermometers and the temperature displays were recorded on film using a high-speed movie camera. Temperature measurements were obtained in the zero-gravity environment by dropping the apparatus in the 2-Seconds Zero-Gravity Drop Tower Facilities of NASA Lewis Research Center. In addition, experiments were also performed in the gravity environment and the results are compared in detail with those obtained under zero-gravity conditions. Author

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N89-11921*# SatCon Technology Corp., Cambridge, Mass.
AN ADVANCED ACTUATOR FOR HIGH-PERFORMANCE SLEWING Final Report
James Downer, David Eisenhaure, and Richard Hockney
Washington NASA Sep. 1988 163 p
(Contract NAS1-18322)
(NASA-CR-4179; NAS 1.26:4179; R05-87) Avail: NTIS HC A08/MF A01 CSCL 13I

A conceptual design for an advanced momentum exchange actuator for application to spacecraft slewing is described. The particular concept is a magnetically-suspended, magnetically gimballed Control Moment Gyro (CMG). A scissored pair of these devices is sized to provide the torque and angular momentum capacity required to reorient a large spacecraft through large angle maneuvers. The concept described utilizes a composite material rotor to achieve the high momentum and energy densities to minimize system mass, an advanced superconducting magnetic suspension system to minimize system weight and power consumption. The magnetic suspension system is also capable of allowing for large angle gimballing of the rotor, thus eliminating the mass and reliability penalties attendant to conventional gimbals. Descriptions of the various subelement designs are included along with the necessary system sizing formulation and material. Author

N89-11922# Sandia National Labs., Albuquerque, N. Mex.
SANDIA TECHNOLOGY, VOLUME 11, NO. 2
Dean Thornbrough, ed., Barry Butcher, ed., Joe Calek, ed., Mel Merritt, ed., and Donna Rix, ed. Dec. 1987 32 p
(DE88-005955; SAND-87-1343-Vol-11-No-2) Avail: NTIS HC A03/MF A01

Topics addressed include: fiber optical communication network; electroforming; aspects of welding; feedback control of gas tungsten arc welding; and seismic arrays in Norway. For individual titles, see N89-11923 through N89-11926.

N89-11923# Sandia National Labs., Albuquerque, N. Mex.
AN OPTICAL-FIBER COMMUNICATION NETWORK FOR THE FUTURE c32
In its Sandia Technology, Volume 11, No. 2 Dec. 1987 p 2-9
(For primary document see N89-11922 03-31)
Avail: NTIS HC A03/MF A01

Scandia National Laboratories in Albuquerque is among the first campus-type facilities in the U.S. to install a very high-capacity, wide-ranging optical-fiber cable and communication network. Begun in 1981, the primary 144-fiber trunk system will soon be completed in a loop 26 miles in circumference. This cable system is the backbone of a communication utility that will make access by terminals to computers as easy as plugging in electrical appliances or making a telephone that works. Author

N89-11924# Sandia National Labs., Albuquerque, N. Mex.
FEEDBACK CONTROL OF GAS TUNGSTEN-ARC WELDING c37
In its Sandia Technology, Volume 11, No. 2 Dec. 1987 p 10-1 (For primary document see N89-11922 03-31)
Avail: NTIS HC A03/MF A01

In gas tungsten arc welding (GTAW) an electric arc is struck between an inert tungsten electrode and the parts being joined, the heat melts the metals to weld them together if filler material is used, which is usually metallic wire of a composition similar to the parts being joined. Oxidation is prevented by surrounding the weld with an inert gas (argon or helium). Currently, good results require the skill of experienced welders. Their skill determines the quality and consistency of GTA welds. Author

N89-11925# Sandia National Labs., Albuquerque, N. Mex.
ELECTROFORMING: ART IN SCIENCE c37
In its Sandia Technology, Volume 11, No. 2 Dec. 1987 p 16-2 (For primary document see N89-11922 03-31)
Avail: NTIS HC A03/MF A01

Electroforming is valuable for special applications in nuclear weapons research and development. It was found to be the best method to use when the need is to fabricate a few parts that have complex shapes or thin cross sections and to have the part quickly at reasonable cost. The basic steps are explained. B.G.

N89-11926# Sandia National Labs., Albuquerque, N. Mex.
SCIENTIFIC ASPECTS OF WELDING c37
In its Sandia Technology, Volume 11, No. 2 Dec. 1987 p 22-2 (For primary document see N89-11922 03-31)
Avail: NTIS HC A03/MF A01

Joining metal parts by welding is an art used since ancient times. Today, as in the past, most welding procedures are developed by trial and error. Optimal welding parameters for critical welding applications are often difficult to determine, particularly when the parts to be joinged are complex in shape and the weld is susceptible to cracking in these cases, the empirical approach can often make an expensive weld development program necessary. An analytical approach to welding was taken that leads to more economical and successful procedures. By their nature, welding phenomena are difficult to study experimentally because the details of what is happening in and near the weld zone are physically inaccessible, occur at high temperature, and change very quickly, even the attempt to measure these phenomena interferes with them. Numerical modeling helps to understand these phenomena that are difficult or nearly impossible to measure. Author

N89-11927# Oak Ridge National Lab., Tenn. Mathematical Sciences Section.
APPLICATION OF THE THIN CAVITY METHOD TO SHIELD CALCULATIONS IN ELECTROPLATING
L. J. Gray and G. E. Giles (Martin Marietta Energy Systems, Inc., Oak Ridge, Tenn.) Apr. 1988 11 p Presented at the BEM-10: 10th Boundary Element Meeting, Southampton, United Kingdom, 6 Sep. 1988
(Contract DE-AC05-84OR-21400)
(DE88-011382; CONF-880974-1; BSC-88/23) Avail: NTIS HC A03

In a computational model of an electroplating tank, a thin shield can be conveniently approximated as a zero-thickness crack. A newly developed boundary element method for treating cracks is especially advantageous for treating complicated three-dimensional geometries, such as plating cell configurations. In particular, nonsmooth shields, i.e., wherein a normal direction is not everywhere defined on the surface, can occur in practical plating applications. This paper will describe a technique for handling non-smooth shields, and calculations for an actual plating configuration will be presented. DOE

N89-11928# Centre Technique des Industries Mecaniques, Senlis (France).
LASER UTILIZATION IN GEAR MANUFACTURING Final Report [EMPLOI LASER POUR REALISATION ENGRENAGES]
J. M. Coevoet 26 Apr. 1988 163 p In FRENCH
(CETIM-102180; ETN-88-93292) Copyright Avail: NTIS HC A08/MF A01

A method to design gear profiles composed of circular arcs and optimized in the sense of minimizing the deviations from the theoretical profile was developed in order to test the automatic manufacturing of gears with a laser tool. The gear design program is described. Tests were performed on alloy steel using a 3 kW CO2 laser with a focal distance of 127 mm. The resulting gears are adequate for low precision work. The steel should not be sensitive to air tempering to avoid localizations of the heat treatment leading to scaling. ESA

N89-11929# Centre Technique des Industries Mecaniques, St. Etienne (France).
ASSEMBLING ENGINEERING Final Report [INGENIERIE DE L'ASSEMBLAGE]
J. Berger, P. Didier, F. Lhote, R. Malosse, M. Meunier, and C. Munier Jun. 1987 344 p In FRENCH
(Contract FRT-85)
(CETIM-105190; ETN-88-93301) Copyright Avail: NTIS HC A15/MF A01

Assembly operation automation, identification of tasks and flow of materials, the characterization of the constitutive units, the characterization of the products, and an analysis of product families are reviewed. ESA

N89-11930# Centre Technique des Industries Mecaniques, Senlis (France).
SYNTHESIS OF ACTUAL KNOWLEDGE ON MACHINE-TOOL MONITORING METHODS AND EQUIPMENT Final Report [SYNTHESE DES CONNAISSANCES ACTUELLES EN METHODES ET MATERIELS DE SURVEILLANCE DE L'USINAGE]
J. C. Tanguy Jun. 1988 27 p In FRENCH
(CETIM-107730; ETN-88-93306) Copyright Avail: NTIS HC A03/MF A01

Problems connected with the automatic supervision of production were studied. Many different automatic control devices are now able to identify defects in the tools, but the solutions proposed to detect optimal limits in the utilization of a tool are not satisfactory. ESA

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N89-11931# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Electromagnetic Wave Propagation Panel.
MEDIA EFFECTS ON ELECTRONIC SYSTEMS IN THE HIGH LATITUDE REGION
Sep. 1988 225 p Lecture series held in Ottawa, Ontario, 29-30 Sep. 1988, in Geilo, Norway, 24-25 Oct. 1988, and in London, United Kingdom, 27-28 Oct. 1988
(AGARD-LS-162; ISBN-92-835-0478-X) Copyright Avail: NTIS HC A10/MF A01

The lecture series directs its attention to propagation problems and solutions for many systems. The topics include satellite communications over polar and auroral latitudes, over-the-horizon radar, low frequency propagation under high latitude conditions, remote sensing of targets and high latitude regions by active and passive EM systems and HF communications at auroral and polar latitudes. Unique lower atmospheric effects and multipath problems of importance at high latitudes are discussed. For individual titles, see N89-11932 through N89-11941.

N89-11932# Army Communications-Electronics Command, Fort Monmouth, N.J. Center for C3 Systems.
MEDIA EFFECTS ON ELECTRONIC SYSTEMS IN THE HIGH LATITUDE REGION
Haim Soicher *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 3 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

Modern technology and state-of-the-art research will permit communications, navigation, and surveillance systems to adapt to the complex and rapidly changing medium. However, such adaptability depends to a large extent on: improvement of prediction of auroral, ionospheric and magnetic disturbances; understanding of the mechanisms responsible for the formation of ionospheric inhomogeneties and the propagation related effects; obtaining the long-term data base; and maintaining real time information flow on the natural electromagnetic and particle radiation background. Author

N89-11933# Lancaster Univ. (England). Dept. of Environmental Science.
THE HIGH-LATITUDE IONOSPHERE: GEOPHYSICAL BASIS
c46
J. K. Hargreaves *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 27 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

This introductory lecture summarizes concepts of the ionosphere and the magnetosphere that are fundamental to our understanding of high-latitude ionosphere. It begins with the basic theory of the ionosphere, particularly the processes of production and loss which lead to the existence of a permanent ionosphere and render the upper atmosphere electrically conducting. The structure of the magnetosphere, which strongly affects the polar regions because of coupling along the geomagnetic field lines, is then reviewed, including the form of the magnetosphere, and the plasma and energetic particles that are contained within the magnetosphere. Author

N89-11934# Northwest Research Associates, Inc., Bellevue, Wash.
TRANSIONOSPHERIC PROBING AND PROPAGATION
E. J. Fremouw *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 23 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

The propagation of radio waves through the ionosphere is necessary for the operation of many C(3)I systems. The aspects of magnetoionic theory that relate to transionospheric probing are discussed, dispensing rather quickly with the bulk-ionosphere effects and concentrating on the effects of spatially irregular total electron content and scintillation. Regarding the latter, the signal statistics of scintillation and the channel parameters that describe those statistics are discussed. The geophysical parameters needed to characterize the plasma-density irregularities that produce scintillation are considered. The focus in this regard is the application to user-oriented computer models. In addition to the foregoing, the experimental techniques used to employ scintillation as a diagnostic tool and the radio sources available for transionospheric probing are discussed. Author

N89-11935# Hamburg Univ. (West Germany). Meteorological Inst.
GROUND/LOWER ATMOSPHERIC CONSIDERATION
H. Jeske *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 22 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

The ground-wave propagation of electromagnetic waves in the frequency range below 30 MHz is especially influenced by the ground characteristics (electrical constants, roughness, obstacles) along the path. For frequencies above 30 MHz the main propagation mechanisms are determined by the vertical stratification of the refractive index in the lowest part of the non-ionized atmosphere. The effects are hardly frequency-dependent. The characteristics of the involved media (ground atmosphere) and their influences on electromagnetic wave propagation are discussed with special emphasis to anomalies due to the complex environment of polar regions. Author

N89-11936# Communications Research Centre, Ottawa (Ontario). Radio Propagation Lab.
HF COMMUNICATIONS AND REMOTE SENSING IN THE HIGH LATITUDE REGION
John S. Belrose *In* AGARD, Media Effects on Electronic Systems

in the High Latitude Region Sep. 1988 42 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

Media effects on high frequency communications are discussed. High latitude disturbance zones and magnetic coordinates; the propagation media in the high latitude region; ground effects; radio noise and interference; results of high frequency communications, direction finding, surveillance and remote sensing at high latitudes; transionospheric high frequency propagation; and over-the-horizon radar are discussed. Author

N89-11937# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France).
H. F. RADAR PROBING (INCLUDING MODIFICATION)
P. Bauer *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 15 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

At high magnetic latitudes (auroral and polar regions), the ionospheric plasma is governed by the geometry of the magnetic field, the experience of particle precipitations (from 100 MeV solar protons to keV electrons), large and small scale convection electric fields, and strong atmosphere/ionosphere coupling processes. As a result, the various forms of free energy sources feed the growth of plasma instabilities which through nonlinear mechanisms lead to a turbulent cascade of ionospheric inhomogeneities from the regional scale of the ion larmor radii. The scales of the irregularities encompass the wavelength ranges of HF systems, thus providing natural targets for HF radars. While highly horizontally stratified in the D and E layers, the targets are essentially aligned along the magnetic field in the F region. HF radar techniques making use of these properties include: partial reflection systems (D and lower E region), E region auroral radars, F region auroral and poler radars. These techniques characterize: the irregularities and the underlying instabilities, the high latitude plasma convection, and the middle atmosphere motions (gravity waves and tides). A better understanding of the basic plasma processes is also provided by HF ionosphere modification experiments performed from the D up to the F region through the excitation of resonant frequencies and through the local change macroscopic properties such as the electron temperature or the electron density. Author

N89-11938# Lancaster Univ. (England). Dept. of Environmental Science.
THE HIGH-LATITUDE IONOSPHERE: DYNAMICAL ASPECTS, AND MODELS c46
J. K. Hargreaves *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 22 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

Whereas the inner magnetosphere co-rotates with the Earth, the outer region circulates in a pattern determined by the solar wind. These motions are communicated along the geomagnetic field-lines to the high-latitude ionosphere, causing F-region plasma to drift bodily and producing electric currents in the E region. The dynamics of the polar ionosphere are characterized by trans-polar drift from day to night and a return flow around the auroral zone. The neutral thermospheric wind is driven by solar heating, and this also flows across the polar caps from day to night sectors. Models are becoming increasingly important in upper-atmosphere geophysics. The extensive data sets now available have enabled empirical models to be compiled. These are essentially mathematical representations of the data in a form suitable for a computer. Where the theory is sufficiently well developed, it is worthwhile to develop a mathematical model based on the fundamental equations governing the phenomenon. The output from such models obviously needs to be checked against data, and they offer a useful technique for studying the fundamentals of complex phenomena. Models - some empirical, some mathematical, and some mixed - have been produced for the structure of the neutral atmosphere, the winds and tides of the thermosphere, the ionosphere, the magnetosphere, and for ionospheric radio propagation. Author

N89-11939# Northwest Research Associates, Inc., Bellevue, Wash.
SATELLITE IN-SITU PROBING
E. J. Fremouw *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 10 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

Of those various media that affect radio propagation, the one that can be probed in situ by means of satellites is the ionosphere. The portion of the ionosphere that can be so probed repeatedly over long periods of time is the F layer. Phenomena that affect and/or can be sensed in the F layer are discussed. Specifically, techniques for, and some recent results on, the two major phenomena identified as affecting the high-latitude ionosphere, particle precipitation and its resulting ionization and ExB drift and the plasma-density irregularities that result therefrom, especially those that produce radiowave scintillation are reviewed. Regarding particle precipitation, attention is confined to electrons in the range of a few tens of eV to a few tens of keV, excluding other species and energies that produce ionization lower that the E layer. Upwelling electrons and the question of balance between currents flowing into and out of the ionosphere, insofar as they can be sensed on board a satellite in the F layer are considered. Thus, we shall consider measurement of the magnetic field, especially the local perturbation field. We'll also indicate the utility of optical remote sensing, in the form of imaging from a platform in the F layer, for providing a plan view related to point measurements on the platform. Primarily we'll consider in-situ measurements of the F-layer thermal plasma, mainly its electron and total ion density, temperature, and drift, giving little attention to the identification of ion species. Accordingly, we'll briefly review the measurement principles of the Langmuir probe, the retarding-potential analyzer, and the ion drift meter. Our consideration of the in-situ electric field will be limited primarily to the d.c. convection field, but it will include structure therein. By way of example, we'll describe in some detail the complement of instruments on board the DNA HiLat and Polar BEAR satellites and results therefrom. Author

N89-11940# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France).
INCOHERENT/COHERENT SCATTER
P. Bauer *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 17 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

Coherent and Incoherent VHF and UHF radars provide a means for studying, in three dimensions, some of the basic physical properties of the atmosphere (from the troposphere up to the thermosphere) and of the ionosphere. The term coherent refers here to pulse phase coherent integration of the scattered radar signals. This technique is applicable whenever the scattering process is stationary over the interpulse period. It is the case for the scattering of electromagnetic waves arising from turbulent atmospheric fluctuations and from ionospheric irregularities. On another hand, incoherent integration has to be used when the scattering occurs from plasma thermal fluctuations in the ionosphere. Mesosphere - Stratosphere - Troposphere (MST) coherent radars give access to atmospheric dynamics (wind and turbulence). Aspect sensitive coherent radars allow one to map the ionospheric electric field and to characterize E region plasma instabilities, whenever such instabilities are sufficiently developed. Incoherent scatter radars provide three dimensional measurements of the electron and ion temperatures, of the electron concentration and of the ion drift vector over the whole ionosphere. Author

N89-11941# Royal Norwegian Council for Scientific and Industrial Research, Kjeller. Environmental Surveillance Technology Programme.
PROPAGATION MEDIUM ADAPTIVE TECHNIQUES FOR ADVERSE COMMUNICATIONS AND FOR REMOTE SENSING
Dag T. Gjessing *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 19 p (For primary

document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

In general terms, an object probed by electromagnetic waves can be characterized by the distribution of scatters along and transverse to the propagation direction, the chemical surface structure of the object, the surface temperature and the motion pattern. A unified set of first order expressions derived from basic physical principles characterizing the scattering object is presented. From these it is shown how the propagation medium affects the results of the various remote sensing techniques. In exactly the same way the factors which characterize the propagation medium in relation to communications are derived. It is shown that in regard to the influence of the propagation medium, the problems related to communications are very much unified with those of remote sensing. Author

N89-11942# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
EFFECT OF A LARGE ROTATING SCATTERER IN A RECTANGULAR CAVITY
D. I. Wu and D. C. Chang (Colorado Univ., Boulder.) Mar. 1988 41 p
(PB88-225693; NBS-TN-1317) Avail: NTIS HC A03/MF A01; also available SOD HC $2.00 as 003-003-02869-0 CSCL 20N

In a mode-stirred chamber, the field in the cavity is perturbed with a stirrer or rotating scatterer so that the time-averaged field is constant. The fundamental properties associated with a perturbing body in a cavity is examined and it is found that the key to effective field perturbation lies in shifting the eigenmode frequencies. The shifting may be large enough that the perturbed modes no longer resemble the original unperturbed modes. In effect, as the body rotates, different perturbed modes may be excited, thus introducing randomness into the system. Using the Transmission-Line-Matrix (TLM) method, the shifting of eigenfrequencies and the variation on the magnitude of the fields for different stirrer sizes are computed. GRA

N89-11943 British Broadcasting Corp., Kingswood (England). Research Dept.
CONDITIONAL ACCESS BROADCASTING. DATACARE 2: AN OVER-AIR ENABLED SYSTEM FOR GENERAL PURPOSE DATA CHANNELS
D. T. Wright Aug. 1988 23 p
(BBC-RD-1988/10) Copyright Avail: BBC, Kingswood Warren, Tadworth, Surrey, United Kingdom

This Report describes an encipherment system, known as Datacare 2, which was originally developed to provide over-air enabled Conditional Access facilities for a Datacast data channel. The key management techniques are based on original proposals for applying Conditional Access facilities to DBS television services but several improvements have been made. In particular, the data protocol for this system allows self-contained operation within a single data channel and permits the complete decoding operation to be performed by a single-chip microprocessor. Author

N89-11944 Pennsylvania Univ., Philadelphia.
APPLICATION OF SUPERRESOLUTION SPECTRAL ESTIMATION TECHNIQUES TO INVERSE SYNTHETIC APERTURE RADAR IMAGING OF SEA SURFACE TARGETS Ph.D. Thesis
Yin-Wu Chen 1987 298 p
Avail: Univ. Microfilms Order No. DA8804891

The to a ship's large size, limitation on motion across range cells and time-varying Doppler frequency, conventional Fourier processing limits the accomplishment of high-resolution imagery of ships. Besides, non-cooperative motion of the ships does not allow the increase in the observation time. These facts motivated the study of the applicability of superresolution spectral estimation techniques to image construction. A complete formulation for range-Doppler imaging is derived. The concept of projection from a three-dimensional distribution of point reflectors on to a two-dimensional image is pointed out by derived signal sample equations. Limitations of conventional FFT-based image construction methods are derived to indicate the situations in which superresolution image construction techniques are needed for ship building. Three basic types of superresolution spectral estimation techniques were studied: Autoregressive Spectral Estimation (ARSE), vector space decomposition approach, and Linear Prediction Extrapolation Method (LPEM). The experiments using the real-target data are conducted to verify the described characteristics of superresolution techniques. Dissert. Abstr.

N89-11945 Exeter Univ. (England).
TRAVELLING WAVE ANTENNAE IN THE UHF BAND Ph.D. Thesis
Ibrahim Rashed Bin-Ghunaim 1987 290 p
Avail: Univ. Microfilms Order No. BRDX81104

The basic purpose is to investigate the attenuation of a traveling wave in an antenna due to radiation. In the main, the V antenna was used for this purpose, although, the rhombic antenna was examined. A technique had to be evolved for measuring input impedance and attenuation. Also, a novel strip line feed arrangement was invented so that the V antenna could be used for a wide frequency band (1/2 - 1 GHz). It was soon realized that the gain of a V antenna could not be increased by simply increasing the length of its arms; most of the power was radiated at the input end of the V antenna making the far ends ineffective. This led to a study of V antenna arrays. Dissert. Abstr.

N89-11946# Air Force Human Resources Lab., Brooks AFB, Tex.
TERRAIN ACCURACY EFFECTS ON SIMULATED RADAR IMAGE QUALITY Final Report, Oct. 1986 - Oct. 1987
Peter M. Crane and Kevin W. Dixon May 1988 18 p
(AD-A196349; AD-E951145; AFHRL-TR-87-69) Avail: NTIS HC A03/MF A01 CSCL 17I

The effect of varying the degree of accuracy in the transformation of terrain elevation data into simulated real beam ground mapping radar was assessed. In two experiments, Air Force navigators judged the quality and training value of simulated radar imagery of a mountainous area produced at six levels of transformation accuracy. The results show that: (1) increasing transformation accuracy above the simulator's current standard did not significantly increase either the judged quality of the imagery or its perceived training value; and (2) decreasing terrain vertical accuracy below the current standard significantly decreased both judged quality and perceived training value. GRA

N89-11947# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
MICROWAVE MOISTURE SOUNDER FEASIBILITY STUDY. PHASE 2: RETRIEVAL OPTIMIZATION Final Report, 12 Aug. 1985 - 14 Feb. 1988
R. G. Isaacs, G. Deblonde, Y. Q. Jin, R. D. Worsham, and C. Grassotti 14 Mar. 1988 131 p
(Contract F19628-84-C-0134)
(AD-A196495; P136; AFGL-TR-88-0058) Avail: NTIS HC A07/MF A01 CSCL 17I

This report documents the results of our two-year Phase 2 effort to investigate the application of data from the proposed DMSP microwave moisture sounder (SSM/T-2) to the inference of water vapor profiles, temperature profiles, cloud, precipitation, and the properties of the underlying surface. The goal of this research is to provide a unified retrieval scheme capable of processing microwave and millimeter wave sensor (i.e., sounder and imager) data which extends the adopted operational algorithm based on a purely statistically based retrieval of temperature profiles from the SSM/T-1, moisture profiles from the SSM/T-2, and surface and atmospheric parameters such as precipitation and integrated cloud liquid water from the SSM/I. The approach uses two concepts to increase retrieval accuracy. First, physical considerations based on the application of the radiative transfer equation are used to quality control the statistically derived first guess retrievals. Second, data sources from colocated microwave mission sensors (i.e., the SSM/T-1, SSM/T-2, and SSM/I) are combined when necessary to more completely characterize the spectral dependence of the observed brightness temperatures on the meteorological properties of the surface and atmosphere. By combining data from all available sensors, the desired meteorological parameters can be more accurately determined. Based on evaluation of cloud effects on millimeter wave brightness temperatures and water vapor retrievals. GRA

N89-11948# Defence Research Establishment, Ottawa. (Ontario).

DYNAMIC RANGE CONSIDERATIONS IN NARROWBAND AND WIDEBAND SUPERHETERODYNE SURVEILLANCE RECEIVERS

Andrew Mudry Mar. 1988 44 p
(AD-A196569; DREO-TN-88-9) Avail: NTIS HC A03/MF A01 CSCL 25B

This report examines the dynamic range performance of narrowband and wideband superheterodyne surveillance receivers. A theoretical review of parameters indicative of the dynamic range performance of each type of receiver is presented. It is seen that for a narrowband superheterodyne receiver, the dynamic range performance can be specified using a parameter based on a single tone at the input. For a wideband superheterodyne receiver, one or more two tone dynamic range parameters are needed. These two tone dynamic range parameters are then used to predict the dynamic range performance of a wideband superheterodyne surveillance receiver currently being built for DREO. Some anticipated dynamic range problems specific to this system are discussed. GRA

N89-11949# Defence Research Establishment, Ottawa. (Ontario).

DOPPLER TARGET SIGNAL GENERATOR

Keith R. Doucet and John Nielson Apr. 1988 43 p
(AD-A196570; DREO-TN-88-14) Avail: NTIS HC A03/MF A01 CSCL 17I

The Threat Radar Simulator (TRS), utilized in DREO's ECM facility, is equipped with a Moving Target Indicator (MTI) processor used to detect the skin echo of moving targets. The MTI unit makes use of a Doppler shift, associated with the moving target, to discriminate between the target and unwanted clutter. To facilitate the MTI's requirement for Doppler shifts in the return pulses, a Doppler Target Signal Generator (DTSG) has been developed at DREO. The DTSG is an X-band programmable frequency synthesizer with three independent outputs. Two of the outputs are used in the generation of target returns and the third output provides a Doppler shift to the clutter return signal. GRA

N89-11950# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

THE PERFORMANCE OF PRECONDITIONED ITERATIVE METHODS IN COMPUTATIONAL ELECTROMAGNETICS Ph.D. Thesis

Charles F. Smith Sep. 1987 77 p
(AD-A196650; AFIT/CI/NR-88-144) Avail: NTIS HC A05/MF A01 CSCL 20C

The numerical solution of electromagnetic scattering problems involves the projection of an exact equation onto a finite dimensional space, and the solution of the resulting matrix equation. By using iterative algorithms, the analysis of scatterers that are an order of magnitude larger electrically may be feasible. Two approaches to achieving the solutions in less time are examined and applied to several typical electromagnetic scattering problems. First, through extensions to the conjugate gradient and biconjugate gradient algorithms, multiple excitations for the same matrix can be simultaneously treated. Depending on the type of problem, the number of excitations, and the algorithm employed, substantial time savings may be achieved. Second, the performance of preconditioning combined with the conjugate gradient, biconjugate gradient, and Chebyshev algorithms is evaluated for typical electromagnetic scattering problems. Preconditioners based on significant structural features of the matrix are able to reduce the overall execution time. GRA

N89-11951# Stanford Univ., Calif. Space Telecommunications and Radioscience Lab.

A STUDY OF ELECTRON BEAM WAVE GENERATION Final Report, Dec. 1983 - Jun. 1986

Peter M. Banks, Rock I. Bush, Antony C. Fraser-Smith, Kenneth J. Harker, and Torsten Neubert May 1988 31 p
(Contract F19628-84-K-0014)
(AD-A196658; D114-1; RADC-TR-88-103) Avail: NTIS HC A03/MF A01 CSCL 20N

This report summarizes theoretical and experimental work on electron beams in space. The purpose was to investigate the possibility of using a modulated electron beam on a space platform as a virtual antenna to radiate electromagnetic waves down to the earth's surface. Our study has established a strong theoretical base from which to make predictions of the electromagnetic radiation produced by a modulated electron beam in space, and it has given much new information about the wave and plasma effects produced in the vicinity of such a beam. Although it necessarily leaves some important questions unanswered, it nevertheless provides substantial support for the virtual antenna concept. Further experiments and theory will be required to establish the optimum conditions for radiation from such an antenna. GRA

N89-11952# Electromagnetic Systems Labs., Inc., Sunnyvale, Calif.

STATISTICAL ANALYSIS OF ADAPTIVE BEAM-FORMING METHODS Final Report

R. C. McCarty 1 May 1988 22 p
(Contract N00014-85-C-0891)
(AD-A196725; ESL-88-0099) Avail: NTIS HC A03/MF A01 CSCL 17A

A statistical measure of the performance of an adaptive beam-forming technique for a multisensor linear array is developed. The sample complex vector signal processes, Z sub K as observed at sample times sub K an element of (OT) is used to calculate a positive, definite, maximum likelihood estimate (M.L.E.) R of the signal process covariance matrix R. Then, an estimated measure of the performance of the array in terms of its ability to suppress an interfering signal is developed from an a priori specified process matrix E(R), its sample. M.L.E. estimate R1 and a form of the Wishart distribution. In particular, such an estimated measure of performance in terms of suppressing an interfering signal with an angle of arrival (AOA) of theta 2 relative to a beam AOA of Theta 1 is the statistic represented by the absolute difference of the L2 norms. Block averaging as required in the sample estimation of 1/R1 provides statistically consistent estimates of the process parameters necessary to the efficient interference suppression of unwanted signals by the beamformer process. Exponential averaging does not provide numerically or statistically consistent estimates of the requisite process parameters either for deterministic or stochastic sample process. GRA

N89-11953# Manchester Univ. (England). Dept. of Pure and Applied Physics.

A STUDY OF THE IDENTIFICATION AND DEVELOPMENT OF PRECIPITATION USING DUAL POLARIZATION RADAR Final Scientific Report, 1 Jul. 1986 - 31 Dec. 1987

Anthony J. Illingworth 20 Jan. 1988 147 p
(Grant AF-AFOSR-0193-86; AF Proj. 2310)
(AD-A196726; AFOSR-88-0663TR) Avail: NTIS HC A07/MF A01 CSCL 17I

This final report describes work performed with the Chilbolton dual polarization radar under contract number AFOSR-86-0193. In addition to measuring the conventional radar reflectivity factor(Z), this radar can measure the differential reflectivity, ZDR, which senses the shape of the precipitation particles. ZDR may be used to differentiate water from ice, to measure the mean size of raindrops and to provide more accurate estimates of rainfall rates. This report is divided into five self-contained parts, each with its own set of diagrams and references. The first four parts consider analysis of Z and ZDR data obtained in 1983 and 1984; the final part describes the first results of a new parameter observed with the reconfigured radar in the fall of 1987. GRA

N89-11954# Defence Research Establishment Pacific, Victoria (British Columbia).

MAXIMUM ENTROPY CRITERIA APPLIED TO SIGNAL RECOVERY

Robert F. MacKinnon and Michael J. Wilmut Jun. 1988 25 p
(AD-A196759; DREP-TM-88-9) Avail: NTIS HC A03/MF A01 CSCL 12I

A method based on the minimization of cross-entropy is presented for the recovery of signals from noisy data either in the form of time series or images. Finite Fourier transforms are applied to the data and constraints are placed on the magnitude and phase of the Fourier coefficients based on their statistics for noise-only data. The minimization of cross-entropy is achieved through application of well-established functional minimization techniques which allow for further constraints in the spatial, temporal or frequency domain. Derivatives of the entropy function are obtained analytically and the results applied to the cases of correlated noise and of signal perturbations about a mean. Demonstrations of applications to one-dimensional data are presented. GRA

N89-11955# Stanford Univ., Calif. Dept. of Computer Science.

A DYNAMIC, CUT-THROUGH COMMUNICATIONS PROTOCOL WITH MULTICAST

G. T. Byrd, R. Nakano, and B. A. Delagi Sep. 1987 30 p
(Contract F30602-85-C-0012)
(AD-A197006; STAN-CS-87-1178; KSL-87-44) Avail: NTIS HC A03/MF A01 CSCL 25E

This paper describes a protocol to support point-to-point interprocessor communications with multicast. Dynamic, cut-through routing with local flow control is used to provide a high-throughput, low-latency communications path between processors. In addition, multicast transmissions are available, in which copies of a packet are sent to multiple destinations using common resources as much as possible. Special packet terminators and selective buffering are introduced to avoid deadlock during multicasts. A simulated implementation of the protocol is also described. GRA

N89-11956# Axiomatix, Los Angeles, Calif.

SIMULATION STUDY OF PERIODIC JAMMING OF ADAPTIVE NETWORKS Interim Technical Report

Unjeng Cheng 30 Jun. 1988 25 p
(Contract DAAL03-87-C-0007)
(AD-A197034; R8806-1; ARO-24649.3-EL-S) Avail: NTIS HC A03/MF A01 CSCL 17D

A periodic jamming attack is more harmful to the networks with the adaptive routing algorithms than the static jamming attack, since the latter can be detected by the communicators and the appropriate actions can be taken to alleviate its effectiveness. The non-existence of the equilibrium state makes the analytical and simulation study difficult. Although the equilibrium state does not exist, the time-average of various entities, such as the packet delay and the node queue size, are valid performance measures. In this report, we use simulation techniques to investigate the behavior of networks under the periodic jamming attack. GRA

N89-11957# Woods Hole Oceanographic Institution, Mass.

SURFACE-WAVE DATA ACQUISITION AND DISSEMINATION BY VHF PACKET RADIO AND COMPUTER NETWORKING

M. Briscoe, E. Denton, D. Frye, M. Hunt, and E. Montgomery Apr. 1988 117 p
(Contract N00014-86-K-0751)
(AD-A197547; WHOI-88-15) Avail: NTIS HC A06/MF A01 CSCL 20N

Waverider buoy data are normally transmitted on a 27 MHz analog radio link to a shore station a few miles away, where the buoy data are plotted on a paper strip-chart recorder or logged digitally for later computer processing. Instead, we have constructed a relay station on Martha's Vineyard island that retransmits the received Waverider data over a digital, 148 MHz packet-radio link a personal computer in our laboratory on Cape Cod, where the data are edited, processed, spectrally analyzed, and then sent over an Ethernet line to our Institution mainframe computer for archiving. Telephone modem access of a special wave-data file on the mainframe permits unattended data dissemination to the public. The report describes the entire system, including Waverider buoy mooring hardware, computer programs, and equipment. The purpose of the project was to learn what difficulties are involved in the automated acquisition and dissemination of telemetered oceanographic data, and to gain experience with packet radio techniques. Although secondary to these purposes, the long-term surface-wave monitoring off the southwest shore of Martha's Vineyard has its own scientific, engineering, and environmental benefits. GRA

N89-11958# Royal Military Coll. of Science, Shrivenham (England).

ADAPTIVE PHASE-ONLY ALGORITHMS FOR OPTIMAL PLANAR ANTENNA ARRAYS Final Report, Apr. 1987 - Apr. 1988

J. C. Mason and Anne E. Damon 16 Jun. 1988 76 p
(Grant AF-AFOSR-0206-87; AF Proj. 2301)
(AD-A197631; EOARD-TR-88-10) Avail: NTIS HC A05/MF A01 CSCL 17I

The positioning of nulls in an antenna array field pattern is essential to the performance of the antenna, in being capable of blocking interference. The null placement must be achieved in such a way that the field pattern in other directions is not adversely affected. One of the most efficient methods of null placement is by perturbing only the phases of the array elements. This document presents two approaches to the placement of nulls by phase perturbation. The first is a least squares method based on exact of approximate null placement, applicable to one-dimensional arrays and extendable to two-dimensional arrays, developed for real quiescent patterns which apparently allows polygonal arrays (in this study, octagonal arrays) to be considered. The second is a minimax method in one or two dimensions based on null placement, which readily permits the omission of failed elements and which involves only the perturbation of selected element phases or amplitudes. GRA

N89-11959# Illinois Univ., Urbana. Coordinated Science Lab.

ELECTROMAGNETIC SCATTERING BY CONDUCTING BY BODIES OF REVOLUTION--SOLUTION USING SUB-DOMAIN AND ENTIRE-DOMAIN BASIS FUNCTIONS

J. Joseph and R. Mittra Aug. 1988 42 p
(Contract N00014-04-C-0149)
(AD-A197723; UILU-ENG-88-2240) Avail: NTIS HC A03/MF A01 CSCL 20C

In this work, the problem of electromagnetic scattering of a plane wave incident on a conducting body of revolution is considered. The body is assumed to be situated in infinite homogeneous space. The problem is solved using the method of moments. Use of two different types of expansion and testing functions, namely, sub-domain type and entire-domain type is considered. Results obtained using sub-domain pulse functions and entire-domain Gaussian functions are presented. The relative advantages and disadvantages of each type of basis functions is discussed. GRA

N89-11960# Naval Ocean Systems Center, San Diego, Calif.

COMPARISON WITH OBLIQUE SOUNDER DATA OF HIGH-LATITUDE HF PROPAGATION PREDICTIONS FROM RADAR C AND AMBCOM COMPUTER PROGRAM

Nikhil Dave Jun. 1988 12 p
(AD-A197731) Avail: NTIS HC A03/MF A01 CSCL 17I

A study is done using two High Frequency (HF) propagation prediction programs - RADAR C and AMBCOM - to determine how well they predict median values of oblique sounder data of maximum observed frequencies (MOF) at high latitudes. The main differences between RADAR C and AMBCOM are the inclusion in the latter of high-latitude ionosphere and auroral absorption models, as well as a more sophisticated and accurate ray-tracing scheme. The data used for comparison are taken for the Winnipeg-Resolute Bay path in the year 1959 and for the Andoya-Ft. Monmouth and

Andoya-College paths in 1964. The data for the Winnipeg-Resolute Bay corresponds to high sunspot number, while the others correspond to low sunspot number. Hence, this study provides information on the performance of the two programs for various high-latitude paths at both high and low sunspot number. AMBCOM was found to give generally better agreement with the above data than did RADAR C. Comparison of details of model predictions from the two computer programs for the above data-base is used to form an understanding of this improvement in prediction capability. GRA

N89-11961* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SWITCHED STEERABLE MULTIPLE BEAM ANTENNA SYSTEM Patent
Richard S. Iwasaki, inventor (to NASA) (Axiomatix, Los Angeles, Calif.) 20 Sep. 1988 15 p Filed 10 Jun. 1987 Supersedes N87-29718 (25 - 24, p 3301)
(NASA-Case-MSC-20873-1-SB; US-Patent-4,772,893; US-Patent-Appl-SN-060196; US-Patent-Class-343-779; US-Patent-Class-343-777; US-Patent-Class-343-778; US-Patent-Class-342-374; US-Patent-Class-342-375) Avail: US Patent and Trademark Office CSCL 20N

A steerable multibeam five element cross-feed cluster antenna system is described. The feed power is divided into five branches. Each branch includes a switching network comprised of a plurality of time delay elements each individually controlled by a respective electromagnetic latching switch. Frequency independent individual two-dimensional beam steering at intermediate (IF) scanning frequencies is thereby provided wherein discrete incremental time delays are introduced by the switching networks into each branch and the signals recombined thereafter to form each beam. The electromagnetic latched switching reduces power consumption and permits higher power switching and reciprocal coincident tranmsit and receive operation. Frequency independence due to incremental time delay switching permits coincident reciprocal operation and steering for transmit-receive signal paths carrying different transmit-receive frequencies. Diagonal quarter wave plates in the waveguides alter polarization from the circular to orthogonal linear to provide transmitter-receiver isolation.
Official Gazette of the U.S. Patent and Trademark Office

N89-11962 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
APPLICATION OF A NEWLY DEVELOPED DETECTION ALGORITHM TO REAL PASSIVE SONAR SIGNALS
W. Brandenburg Feb. 1988 33 p In GERMAN; ENGLISH summary
(Contract BMvG-T/RF-31/G-0022/G-1312)
(FB-2-88; Lfd-271; ETN-88-93212) Copyright Avail: Fachinformationszentrum Karlsruhe, 7514 Eggenstein-Leopoldshafen 2, Fed. Republic of Germany

Theoretical considerations about the detection of target signals in passive direction finding SONAR systems are applied to experimental towed array data. A detection algorithm was supplemented by features which refer to the different possibilities of exploiting the bandwidth of the target signals, to the problem of suppressing sidelobe targets, and to the possibility of separating point targets from multiple targets, that cannot be resolved in azimuth. ESA

N89-11963 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
INVESTIGATION ON THE INFLUENCE OF ANTENNA GEOMETRY ON THE PERFORMANCE OF A SENSOR SYSTEM
O. Schmid and Chr. vonWinterfeld Mar. 1988 34 p In GERMAN; ENGLISH summary
(Contract BMvG-T/RF-31/D0037/D1332)
(FB-3-88; LED-272; ETN-88-93213) Copyright Avail: Fachinformationszentrum Karlsruhe, 7514 Eggenstein-Leopoldshafen 2, Fed. Republic of Germany

Errors in sensor performance due to interaction of an antenna with an incident wave field were studied. The numerical analysis assumes a simple linear array on a cylindrical surface of finite dimension in a scalar wave field. Examples for linear signal processing (beam forming) and nonlinear original processing are given. ESA

N89-11964# Newtec Cy. N.V., Antwerp (Belgium).
SPACEMAIL RECEIVE-ONLY EARTH STATION Final Report
Dirk Breynaert and Johan DeNolf Paris, France ESA Jun. 1988 17 p
(Contract ESTEC-6745/86-NL-PR)
(ESA-CR(P)-2654; ETN-88-93251) Avail: NTIS HC A03/MF A01

The terminal used to receive documents sent via ESA's Spacemail system (a simplified version of Apollo) is described. The outdoor unit is made of a prime focus antenna of 2 m, a low noise converter, and an associated local oscillator. At an intermediate frequency around 1.1 GHz the signal is passed over 100 m of cable to the indoor unit near the user terminal. The front-end of the indoor unit consists of a down-converter from the 1 GHz band to a fixed frequency of 70 MHz. It is followed by the demodulator, a half-rate Viterbi decoder, a data energy dispersal descrambler, and an SMS deframer which interfaces to the user document terminal. The document terminal consists mainly of an IBM-AT compatible personal computer with an X21 interface card and adapted software. ESA

N89-11965# Physics and Electronics Lab. TNO, The Hague (Netherlands).
NODELESS AREA COMMUNICATION SYSTEMS (NACS): CHARACTERISTICS AND APPLICATIONS
A. J. Ruizenaar Jun. 1987 43 p
(Contract A86/KL/045)
(FEL-1987-42; TD-87-3650; ETN-88-93409) Avail: NTIS HC A03/MF A01

The characteristics, possibilities, positive and negative aspects, and possible operational applications of a nodeless area communication system in the post 2000 era are described. A possible type of system packet radio is described. The most important parameters of a packet radio system are summarized. ESA

N89-11966# Physics and Electronics Lab. TNO, The Hague (Netherlands).
NODELESS AREA COMMUNICATION SYSTEMS (NACS): DESCRIPTION AND RESULTS OF A SINGLE HOP NACS SIMULATION
A. J. Ruizenaar Oct. 1987 55 p
(Contract A86/KL/045)
(FEL-1987-77; TD-87-5667; ETN-88-93413) Avail: NTIS HC A04/MF A01

The structure, the parameters, and the results of a single hop packet radio network (nodeless area communication system) simulator are described. The simulator, which is developed on the VAX 11/750 and programmed in VAX/Pascal and VAX/GKS, has a modular structure. The simulation program can also be used for local area networks. The system can process traffic loads up to 50 percent of the total channel capacity. ESA

N89-11967# Physics and Electronics Lab. TNO, The Hague (Netherlands).
HIGH RESOLUTION PARAMETER ESTIMATION
A. G. Huizing and G. C. deValk Sep. 1987 80 p
(FEL-1987-82; TD-87-5907; ETN-88-93414) Avail: NTIS HC A05/MF A01

The estimation of frequencies of multiple sinusoids in noise from a limited number of samples is discussed. In case of closely spaced frequencies, conventional Fourier techniques are ineffective and high resolution algorithms provide a better performance. These estimation techniques can be applied to radar systems with an array antenna to determine the directions of closely spaced targets. The theoretical background of algorithms is presented and their mutual relationship is explained. The performance of the algorithms in direction estimation problems is studied by computer simulations.

The accuracy of the direction estimates is compared with a theoretical lower bound (Cramer-Rao) on the variance of the estimates. The simulations show that a method called stochastic approximation is the best performing algorithm in terms of statistical properties, resolving capability, and computational effort. ESA

N89-11968# Royal Signals and Radar Establishment, Malvern (England).
THE GILLICK TEST: A METHOD FOR COMPARING TWO SPEECH RECOGNISERS TESTED ON THE SAME DATE
S. J. Cox Feb. 1988 10 p
(RSRE-Memo-4136; BR106923; ETN-88-93552) Copyright
Avail: Defence Research Information Centre, 65 Br own Street, Glasgow G2 8EX, Scotland

The Gillick test for deciding whether the difference between the error rates of two speech recognition algorithms tested on the same data is significant is introduced. It takes account only of utterances on which the classifiers disagree. Depending on the distribution of errors, it can place a much higher statistical significance on the difference in the error rates than that given by the (almost always incorrect) assumption of two independent test sets. It is very simple to apply and it is recommended that it be used whenever two recognizers are tested on the same data. ESA

N89-11969# Royal Signals and Radar Establishment, Malvern (England).
EXPERIMENTS IN MINIMALLY DISTINCT WORD-PAIR DISCRIMINATION USING THE MULTI-LAYER PERCEPTRON
R. K. Moore and S. M. Peeling Apr. 1988 46 p
(RSRE-Memo-4153; BR106952; ETN-88-93554) Copyright
Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

The multi-layer perceptron is investigated as an approach to the automatic discrimination of spoken minimally distinct word-pairs. The choice of the parameters for the multilayer perceptron is discussed and experimental results are reported. A comparison is made with hidden Markov modeling applied to the same data. The results show that the discrimination accuracy obtained using the multilayer perceptron is superior to that attained using hidden Markov modeling. ESA

N89-11923# Sandia National Labs., Albuquerque, N. Mex.
AN OPTICAL-FIBER COMMUNICATION NETWORK FOR THE FUTURE
In its Sandia Technology, Volume 11, No. 2 Dec. 1987 p 2-9
(For primary document see N89-11922 03-31)
Avail: NTIS HC A03/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N89-11970# Ortel Corp., Alhambra, Calif.
ELECTRO-OPTIC TECHNIQUES FOR VERY LARGE SCALE INTEGRATED INTERCONNECTS Final Report, 1 Sep. 1987 - 1 Mar. 1988
Jam Y. Lau, Sze-Keung Kwong, and Israel Ury 20 Apr. 1988 69 p
(Contract DAAH01-87-C-0983; ARPA Order 5916)
(AD-A194238) Avail: NTIS HC A04/MF A01 CSCL 09A

Superluminescent diodes with broad emission spectrum, which makes them insensitive to optical feedback and hence most suitable for massively interconnected systems, were fabricated with an integrated modulator. The superluminescent diode has high emission power (up to 30mW) which makes possible systems with many levels of branchings. The modulator is based on carrier induced absorption and shows a very high modulation efficiency. In addition to device fabrication and experimental measurements which shows a direct modulation bandwidth beyond 1GHz, the static and dynamics of the superluminescent diode, with and without the integrated modulator, were analyzed. It is shown that by using quantum well materials much improvement in modulation efficiency as well as bandwidths in the multigigahertz range can be accomplished. Author

N89-11971# Optical Society of America, Washington, D. C.
TOPICAL MEETING ON PICOSECOND ELECTRONICS AND OPTOELECTRONICS Final Report, 1 Jan. - 10 Oct. 1987
J. W. Quinn 10 Oct. 1987 29 p Meeting held in Incline Village, Nev., 14-16 Jan. 1987; sponsored by AFOSR, IEEE, NSF, ONR, and the Optical Society of America
(Grant N00014-87-G-0050)
(AD-A187137) Avail: NTIS HC A03/MF A01 CSCL 09C

The purpose of this conference was to bring together workers in the areas of electronics and optoelectronics who share a common interest in the physics and technology of picosecond solid state devices, their multigigahertz applications and ultrafast measurement techniques. Subjects covered included: optoelectronic devices; semiconductor device physics; electronic devices; cryo-electronics; device fabrication technology; device characterization; and circuits and signal processing. For individual titles, see N89-11972 through N89-11979.

N89-11972# Amoco Oil Co., Naperville, Ill. Research Center.
ELECTRO-OPTIC SAMPLING ANALYSIS OF TIMING PATTERNS AT CRITICAL INTERNAL NODES IN GIGABIT GaAs MULTIPLEXERS/DEMULTIPLEXERS
X.-C. Zhang, R. K. Jain, and R. M. Hickling (GigaBit Logic, Newbury Park, Calif.) *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 203-204 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 09A

Picosecond electro-optic sampling (EOS) has already been demonstrated by several researchers to represent a unique capability for direct noninvasive probing of GaAs integrated circuits with high temporal resolution. The use is described of the capability for a detailed analysis of on-chip waveforms at critical internal nodes in gigabit sequential logic circuits. Besides providing vital timing information between such internal nodes (and thereby providing the first clear measurements of timing parameters such as set-up and hold-times in flip-flops, and gate propagation delays is normally loaded and normally exercised gates), such as EOS measurements report the first observation of effects such as clock feedthrough at internal nodes, as well as provide indispensable information on the accuracy of the modeling/simulations that are usually done for the analysis of quirks in the internal behavior of such circuits. Author

N89-11973# Bell Telephone Labs., Inc., Holmdel, N. J.
ON 16 Gbit/s DIRECT MODULATION OF AN InGaAsP LASER
c36
A. H. Gnauck and J. E. Bowers *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 205-206 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 09C

The fastest transmission systems demonstrated to date are at a bit rate of 8 Gbit/s. Laser modulation experiments at 10 Gbit/s NRZ and 8 Gbit/s RZ were recently reported as well as simulations using the highest frequency components of a 16 Gbit/s NRZ code. Recent improvements in the cut off frequency of FETs and increases in laser modulation bandwidth now allow the investigation of optical systems at higher speeds by electronically multiplexing pseudorandom 2 Gbit/s signals of length 2 sup 15 -1 into a 16 Gbit/s NRZ bit stream. An experimental system is illustrated. The electronic input was an 8 Gbit/s NRZ bit stream created by multiplexing four pseudorandom 2 Gbit/s signals of length 2 sup 15 -1. The 8 Gbit/s signal was split into two identical signals using a broadband resistive divider, and one output was then delayed in a coaxial cable for 2.0 ns with respect to the other. Both signals were converted to RZ format by multiplying each against an 8 GHz sine wave in separate hybrid dual-gate GaAa FET circuits. The 8 Gbit/s RZ signal were resistively combined to produce the 16 Gbit/s NRZ signal shown. This signal was then amplified in a hybrid GaAs FET driver circuit to provide up to 1.5 Vpp. Author

N89-11974# IBM Watson Research Center, Yorktown Heights, N.Y.
ADVANCES IN BIPOLAR IC TECHNOLOGY
D. D. Tang and T. H. Ning *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 207-209 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 09C

Si bipolar transistors and integrated circuits are widely used for high performance gate arrays and high speed cache memories, and have since become the backbone of the high speed computers. Steady improvements in the understanding of the design and scaling of the small dimension bipolar transistors together with the advances in the process technology have led to the realization of ever faster bipolar transistor and circuits. The improvement is expected from scaling down to 0.25 micron dimension. The theoretical limit of scaling is reached when the base width is reduced to about 25 nm. At such a dimension, the mean free path of electron is comparable to the base width and the validity of the statistical drift diffusion equation describing the device operation becomes questionable. Various second order effects in device physics which were of no concern in designing 2 micron or larger devices now become important at one micron and submicron level. They are the heavy doping effects in the base, the reverse tunneling current, the contact to the shallow emitter and the base widening effects. These and further advances are briefly discussed. Author

N89-11975# Hughes Research Labs., Malibu, Calif.
DEVELOPMENT OF 18 GHz GaAs STATIC FREQUENCY DIVIDERS AND THEIR EVALUATION BY ELECTROOPTIC SAMPLING
J. F. Jensen, K. J. Weingarten, and D. M. Bloon (Stanford Univ., Calif.) *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 210-212 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 09C

Digital integrated circuits (ICs) operating at clock rates above 10 GHz will have a significant impact on the performance of digital systems. Advanced design and fabrication techniques were employed to raise the operational frequency of room temperature GaAs MESFET divider circuits to 18 GHz, which exceed speeds achieved by any other technology at any temperature. Because of the limited bandwidth of conventional electronic instrumentation, measurement of digital performance above 10 GHz is generally a very formidable task. Large signal digital operation was verified and signal timing on internal circuit nodes was characterized using electrooptic testing techniques. Internal gate delay measurements from electrooptic sampling agree very well with gate delays estimated from the measurements of the maximum flip flop frequency. Author

N89-11976# Bell Telephone Labs., Inc., Holmdel, N. J.
OPTICAL READING OF InGaAs MODULATION DOPED FIELD EFFECT TRANSISTOR **c75**
I. Bar-Joseph, D. S. Chemis, C. Klingshirn, D. A. B. Miller, J. M. Kuo, and T. Y. Chang *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 213-217 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 20L

The first observation of absorption quenching in a semiconductor quantum well by electrical control of the carrier density is presented. This novel effect was observed at room temperature in a single modulation doped InGaAs quantum well which was used as the conducting channel of a field effect transistor (FET). The effect is extremely large and it was used for direct optical determination of the state of the FET. Modulation doping (MD) can be used to introduce carriers in QW, producing very high mobility materials well known for their application to high speed transport. Because the carriers fill the two dimensional subbands up to the Fermi energy, the absorption edge is blue shifted with respect to the luminescence emission, with a shift approximately proportional to the number of carriers. Thus electrically driven changes of the carrier density in a MD-QW will result in large changes in optical absorption. The conditions for the observation of this phenomenon correspond exactly to the situation encountered during the switching of a FET whose conducting channel is a MD-QW. Author

N89-11977# Bell Communications Research, Inc., Red Bank, N.J.
PHOTOEMISSIVE TESTING OF HIGH-SPEED ELECTRICAL WAVEFORMS
A. M. Weiner, R. B. Marcus, P. S. D. Lin, and J. H. Abeles *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 218-219 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 09C

Photoemissive sampling was recently introduced as a new, contactless method for probing high speed electrical waveforms on circuits and devices on any semiconductor. Previously the best temporal resolution achieved was limited to 40 psec. Photoemissive sampling measurements are described which demonstrate a temporal resolution below 7 psec. Photoemissive sampling utilizes ultrashort optical pulses to stimulate the emission of photoelectrons from metal interconnection lines on the surface of the device under test: the potential at the emitting surface is derived by spectral analysis of the photoelectrons. The temporal resolution of photoemissive sampling is governed by the photoelectron transit time through the region of space in which the electric field depends significantly on the sample potential. Photoemissive sampling measurements were performed of electrical transients on a 5 micron gold coplanar stripline on GaAs. The experiments demonstrate that photoemissive sampling is capable of probing 50 GHz signals with a temporal resolution well below 10 psec. Author

N89-11978# IBM Watson Research Center, Yorktown Heights, N.Y.
LASER PULSED E-BEAM SYSTEM FOR HIGH SPEED I.C. TESTING **c36**
Paul May, Jean-Marc Halbout, and George Chiu *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 220-222 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 09C

Electron probe techniques for the high speed testing of Integrated Circuits have considerably high spatial resolution compared to optical techniques but have tended to suffer from poorer temporal resolution. A novel type of instrument is described that combines the advantages of conventional SEM voltage contrast techniques (including a spatial resolution better than 0.1 micron and beam steerability) with an order of magnitude improvement in temporal resolution. Author

N89-11979# Bell Telephone Labs., Inc., Murray Hill, N. J.
A NEW 10 MICROMETER INFRARED DETECTOR USING INTERSUBBAND ABSORPTION IN RESONANT TUNNELLING GaAlAs SUPERLATTICES **c76**
B. F. Levine, K. K. Choi, C. G. Bethea, J. Walker, and R. J. Malik *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 223-224 Previously announced in IAA as A87-39157 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 20L

A novel 10.8 micrometer superlattice infrared detector based on doped quantum wells of GaAs/AlGaAs is demonstrated.

Intersubband resonance radiation excites an electron from the ground state into the first excited state, where it rapidly tunnels out producing a photocurrent. A narrow bandwidth (10 percent) photosensitivity of 0.52 A/W and an estimated speed of 30 ps are achieved. Author

N89-11980# Washington Univ., Seattle. Dept. of Computer Science.
[RESEARCH ACTIVITIES OF THE NORTHWEST LABORATORY] Semiannual Technical Interim Report No. 6, 17 Nov. 1987 - 11 Apr. 1988
Apr. 1988 50 p
(Contract MDA903-85-K-0072; ARPA Order 456-3/2)
(AD-A195064; ITR-88-24-06) Avail: NTIS HC A03/MF A01 CSCL 09C

Topics addressed include: Washington Intermediate Notation descriptions of circuit families; network C development; WireLisp; layouts from functional language specifications; APEX; computer aided design tools; architectural comparisons; and circuit parallelism. For individual titles, see N89-11981 through N89-11983.

N89-11981# Washington Univ., Seattle. Dept. of Computer Science.
THE PLANAR TOPOLOGY OF FUNCTIONAL PROGRAMS
Martine Schlag *In its* Research Activities of the Northwest Laboratory Apr. 1988 20 p (For primary document see N89-11980 03-33)
Avail: NTIS HC A03/MF A01 CSCL 09C

The use of applicative language (FP) in VLSI design was advocated, because it provides not only the structure of a circuit, but the planar organization of its components and their interconnections. The level of geometric detail implied by the functional programming style is formalized. The motion of planar topology of an integrated circuit layout is defined and shown to be the appropriate level of geometric information to infer from an FP specification of a circuit. This definition provides a normal form for the representation of the planar topology of a layout which is not only unique, but is optimal over all representations of the same planar toplogy with respect to topological cost measures. This normal form is exploited to improve the wiring of the layouts; it is realized by the applications of transformations to the FP specification. The specification of a carry-save array multiplier is used as an example to illustrate how this optimization reduces the effort required to specify an integrated circuit. Author

N89-11982# Washington Univ., Seattle. Dept. of Computer Science.
AN EMPIRICAL STUDY OF ON-CHIP PARALLELISM
Mary L. Bailey and Lawrence Snyder *In its* Research Activities of the Northwest Laboratory Apr. 1988 6 p (For primary document see N89-11980 03-33)
(Contract MDA903-85-K-0072)
Avail: NTIS HC A03/MF A01 CSCL 09C

A methodology for empirically determining the amount of parallelism on a CMOS VLSI chip is presented. Six chips are measured, and the effect of input choice and circuit size is studied. The unexpectedly low parallelism measured here suggests that certain strategies for parallel simulators may be doomed, and earlier efforts to extrapolate parallelism from small circuits to large circuits may be overly optimistic. Author

N89-11983# Washington Univ., Seattle.
A MODEL FOR ARCHITECTURAL COMPARISON
Sam Ho and Larry Snyder *In its* Research Activities of the Northwest Laboratory Apr. 1988 15 p (For primary document see N89-11980 03-33)
(Contract MDA903-85-K-0072)
Avail: NTIS HC A03/MF A01 CSCL 09C

Recently, architectures for sequential computers became a topic of much discussion and controversy. At the center of this storm is the Reduced Instruction Set Computer, or RISC, first described at Berkeley in 1980. While the merits of the RISC architecture cannot be ignored, its opponents have tried to do just that, while its proponents have expanded and frequently exaggerated them. This state of affairs has persisted to this day. No attempt is made to settle this controversy, since indeed there is likely no one answer. A qualitative framework is provided for a rational discussion of the issues. Author

N89-11984# Sandia National Labs., Albuquerque, N. Mex.
AIR CORE PULSE TRANSFORMER DESIGN
J. P. OLoughlin, J. D. Sidler, and G. J. Rohwein 1988 6 p
Presented at the 18th Power Modulator Symposium, Hilton Head, S.C., 20 Jun. 1988
(Contract DE-AC04-76DP-00789)
(DE88-012670; SAND-88-0588C; CONF-880699-6) Avail: NTIS HC A02

Cylindrical air core pulse transformers capable of passing high voltage/energy pulse waveforms with high efficiency and low distortion require a much more delicate design balance of physical dimensions and electrical parameters that iron or ferrite core units. The two salient advantages of the air core transformer are a much lighter weight and a simplified high voltage insulation system. Special computer codes were written to evaluate the performance. The analysis includes calculation of the self and mutual inductances as determined by the dimensions and insulation stress, evaluation of the waveforms distortion and energy transfer efficiency. Graphical data are given for the optimization in terms of electrical parameters. The results are in agreement with experimental data. It is concluded that air core transformers are feasible operating at hundreds of kilovolts and tens of kioljoules in the microsecond region with energy transfer efficiencies of 70 to 85 percent. The insulation stresses required are in the 100 to 300 kV/em range. Effects of the high frequency current distribution in the windings and the use of slug type ferrite cores are also evaluated. DOE

N89-11985# Texas Instruments, Inc., Dallas.
ULTRASMALL ELECTRONICS ARCHITECTURES Final Technical Report, 5 Aug. 1985 - 4 Aug. 1987
G. A. Frazier 15 Jan. 1988 402 p
(Contract N00014-85-C-0760)
(AD-A196736) Avail: NTIS HC A18/MF A01 CSCL 09A

Ultrasmall electronics research (nanoelectronics) aims at providing quantum semiconductor devices and device-level architectures that challenge fundamental physical limits. This report summarizes our progress in developing an architectural basis for nanoelectronics. We have determined that the cellular automaton (CA) best satisfies the requirements of nanoelectronic architecture. We quantified the dynamic behavior of CAs and determined useful computational properties of nanometer-sized devices. GRA

N89-11986# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
COMPUTER AIDED DESIGN OF MONOLITHIC MICROWAVE AND MILLIMETER WAVE INTEGRATED CIRCUITS AND SUBSYSTEMS Final Technical Report, 1 Sep. 1984 - 31 Dec. 1986
Walter H. Ku, Guan-Wan Gang, J. Q. He, and I. Ichitsubo May 1988 69 p
(Grant AF-AFOSR-0345-84; AF Proj. 2305)
(AD-A196760; AFOSR-88-0632TR) Avail: NTIS HC A04/MF A01 CSCL 09A

This final technical report presents results on the computer aided design of monolithic microwave and millimeter wave integrated circuits and subsystems. New results include analytical and computer aided device models of GaAs MESFETs and HEMTs or MODFETs, new synthesis techniques for monolithic feedback and distributed amplifiers and a new nonlinear CAD program for MIMIC called CADNON. This program incorporates the new MESFET and HEMT model and has been successfully applied to the design of monolithic millimeter-wave mixers. GRA

N89-11987# Stanford Univ., Calif. Dept. of Computer Science.
STRING-FUNCTIONAL SEMANTICS FOR FORMAL VERIFICATION OF SYNCHRONOUS CIRCUITS

Alexandre Bronstein and Carolyn L. Talcott Jun. 1988 60 p
(Contract N00039-84-C-0211)
(AD-A197008; STAN-CS-88-1210) Avail: NTIS HC A04/MF A01 CSCL 12F

A new functional semantics is proposed for synchronous circuits, as a basis for reasoning formally about that class of hardware systems. Technically, we define an extensional semantics with monotonic length-preserving functions on finite strings, and an intensional semantics based on functionals on those functions. As support for the semantics we prove the equivalence of the extensional semantics with a simple operational semantics, as well as a characterization of circuits which obey the every loop is clocked design rule. Also, we develop the foundations in complete detail both to increase confidence in the theory, and as a prerequisite to its future mechanization. GRA

N89-11988# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RESEARCH ON HIGH ENERGY DENSITY CAPACITOR MATERIALS Final Report, 6 Jan. 1983 - 30 Oct. 1984
Robert Somoano Apr. 1988 54 p
(Contract F04611-83-X-0029)
(AD-A197018; AFAL-TR-88-046) Avail: NTIS HC A04/MF A01 CSCL 09A

The Pulsed Plasma thruster is the simplest of all electric propulsion devices. It is a pulsed device which stores energy in capacitors for each pulse. The lifetimes and energy densities of these capacitors are critical parameters to the continued use of these thrusters. This report presents the result of a research effort conducted by JPL into the materials used in capacitors and the modes of failure. The dominant failure mechanism was determined to be material breakdown precipitated by heat build-up within the capacitors. The presence of unwanted gas was identified as the source of the heat. An aging phenomena was discovered in polycarbonate based capacitors. CO build-up was noted to increase with the number of times the capacitor had been discharged. Improved quality control was cited as being essential for the improvement of capacitor lifetimes. GRA

N89-11989# Science Applications International Corp., McLean, Va. Applied Physics Operation.
THEORETICAL STUDIES OF A TRANSIENT STIMULATED RAMAN AMPLIFIER Final Report, Nov. 1986 - Apr. 1988
Curtis R. Menyuk and Godehard Hilfer 19 Apr. 1988 343 p
(Contract N00014-86-C-2341)
(AD-A197035; SAIC-88/1674) Avail: NTIS HC A15/MF A01 CSCL 09C

This final report summarizes Science Applications International Corporation's performance on contract no. N00014-86-C-2341 for the Naval Research Laboratory. Our principle deliverable, the codes RAM2D1 and PRAM1 have been completed on schedule and run successfully. Their operation is described in detail in this report as well as their application to cases of experimental importance. We have also carried out a number of analytical calculations in order to obtain greater insight into the code operation and the experiments and to make predictions in regimes of possible experimental interest which have not yet been explored. Some of these calculations were carried out in collaboration with Dr. John Reintjes of the Naval Research Laboratory. These calculations are summarized in this report. Relevant publications and presentations are also included. GRA

N89-11990# Sandia National Labs., Albuquerque, N. Mex. Storage Batteries Div.
EVALUATION OF TERRESTRIAL NICKEL/HYDROGEN CELLS AND BATTERIES
Donald M. Bush May 1988 32 p
(Contract DE-AC04-76DP-00789)
(DE88-014702; SAND-88-0435) Avail: NTIS HC A03/MF A01

A nickel/hydrogen battery is being developed for terrestrial applications such as remote solar. The main thrust continues to be the reduction of cost compared with aerospace technology. The latest battery design consists of individual prismatic cells in a sealed common pressure vessel. The development work has been conducted at COMSAT Laboratories and, more recently, at Johnson Controls, Inc., under cost-sharing contracts. Contract deliverables include cells and batteries for evaluation, with six cells and two batteries currently on test at Sandia. Continuous-cycle testing is conducted, as well as tests to characterize the system. Also, solar tests have been conducted with a battery connected directly to a photovoltaic array. The results of these tests are discussed. DOE

N89-11991# North Carolina Univ., Chapel Hill. Labs. of Chemistry.
SOLID STATE VOLTAMMETRY AND SENSORS IN GASES AND OTHER NON-IONIC MEDIA Performance Report, 1 Apr. 1987 - 31 Mar. 1988
Royce W. Murray 1988 2 p
(Contract DE-FG05-87ER-13675)
(DE88-014738; DOE/ER-13675/1) Avail: NTIS HC A02/MF A01

Progress is briefly described in the design and performance of an electrochemical microcell. This microcell contacts wire tips of 10-micron Pt working microelectrode and Ag reference and Pt auxiliary electrodes, sealed in glass and plastic, with a few micrometer thick film of an ionically conducting polymer solvent containing dissolved electroactive monomers. The other side of the polymer film is contacted by a selected bathing gas from which other reagents can sorb into the polymer as reactants or as plasticizers. Using lithium triflate/poly(ethylene oxide), PEO LiCF3SO2, as the ionically conducting polymer solvent and species like ferrocene as electroactive solute, we demonstrated that quantitatively interpretable cyclic voltammetry could be carried out. We have recently completed work on a second and more elegant microcell design that defines the three electrodes of the cell microlithographically, with the working electrode being either a 11x516 11x256 micron microband or an 11x11 micron square. Other work concerns electrochemical reactivity in PEO LiCF3SO2 and other polymer solvents. DOE

N89-11992# AT and T Technologies, Inc., Greensboro, N.C.
GALLIUM ARSENIDE PILOT LINE FOR HIGH PERFORMANCE COMPONENTS. SARGIC HFET (SELF ALIGNED REFRACTORY GATE INTEGRATED CIRCUIT/HETRO-JUNCTION FET) DESIGN MANUAL
2 Jun. 1988 159 p
(Contract F29601-87-C-0202)
(AD-A197568) Avail: NTIS HC A08/MF A01 CSCL 09A

This manual describes and layout of GaAs integrated circuits using SARGIC/HFET (Self Aligned Refractory Gate Integrated Circuit/Hetro-junction Field effect Transistor) process. It is divided into three sections, layout design rules, device terminal characteristics, and process control monitor (PCM). The first section outlines the layout of digital GaAs circuits in the SARGIC/HFET, 2 micrometers design rules. It describes the circuit layout procedure level by level, and includes the process's layout design rules. The second section contains the terminal characteristics of Enhancement (EHFET), Depletion (DHFET), and diode devices. This includes drain and gate I/V and capacitance curves modeled by AT and T's ADVICE circuit simulator at 25 and 125 C. The last section includes the design and layout of the Process Control Monitor (PCM). The PCM contains test structures for process control and the extraction of circuit simulator models and device S parameters. This allows the foundry to test for process biases, extract process/device parameters, ADVICE models, and gate propagation delays and noise margins. GRA

N89-11993# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CURRENT SITUATION OF THE DEVELOPMENT AND MANUFACTURE OF VARY LARGE SCALE INTEGRATED DEVICES IN CHINA
He Yubiao 24 Jun. 1988 14 p Transl. into ENGLISH from Dianxin Jushu (Peoples Republic of China), no. 8(161), 1987 p

27-29
(AD-A197740; FTD-ID(RS)T-0256-88) Avail: NTIS HC A03/MF A01 CSCL 09A

The manufacture of Large Scale Integration (LSI) and Very Large Scale Integration (VLSI) devices in foreign countries is a highly competitive high-tech industry. It requires high-precision manufacturing technology, and very expensive manufacturing equipment. Therefore, it is impossible to conduct research and form industrial production capability by merely relying on obsolete manufacturing equipment and semi-manual production techniques. According to the experience of our foreign counterparts and based on our current situation, it is highly desirable for domestic LSI and VLSI research institutes and manufacturers to establish unified development-manufacturing units, concentrate resources, amass available funds to upgrade equipment and technology, improve management, conduct theoretical research, and develop new technology and new devices under a unified planning and assigned responsibility. It is only in this way that we can reduce the gap between domestic and foreign VLSI device industries, and promote our micro-electronic industry. This should be the trend for the development of the microelectronic industry in China. GRA

N89-11994# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
OPTIMIZATION OF OVERSIZED CORRUGATED WAVEGUIDE BENDS FOR HIGHER-ORDER TE(0n)-MODES AT 140 GHz
Annemarie Jacobs Oct. 1987 70 p In GERMAN; ENGLISH summary
(IPF-87-6; ETN-88-93216) Avail: NTIS HC A04/MF A01

Oversized corrugated 90 deg waveguide bends with a waveguide diameter of 27.79 mm were optimized for TEsub0n (n = 3...6) transmission lines to transmit power of 200 kW for electron cyclotron resonance heating of plasmas in thermonuclear fusion research at a frequency of 140 GHz. The corrugation removes the degeneracy of the mode pairs TEsub0n/TMsub1n. The bends were optimized by numerical integration of the coupled-mode differential equations for six coupled modes: TEsub0n, HEsub1n, EHsub1n, EHsub1,n+1, HEsub2n, and EHsub2n. During the optimization procedure three parameters were varied: curvature distribution, corrugation depth, and arc length. The following curvature distributions were studied: sine, sine-squared, triangular, and specific Fourier series. The last is found to be the best. The optimum corrugation depth increases with increasing mode number n, whereas the arc length decreases. A small elliptical deformation of less than 0.04 mm has a negligible influence on TEsub03 and TEsub04-bends. In the case of TEsub05 and TEsub06-bends the arc length must be increased in order to obtain a pure output mode. ESA

N89-11995# Salford Univ. (England). ISIM Simulation.
ESA SIMULATION LANGUAGE (ESL) BATTERY MODEL UPGRADE Final Report
J. L. Hay and J. R. Owen Paris, France ESA Mar. 1988 60 p
(Contract ESA-6466/85-NL-MA)
(CS-1036/00-FIN5; ESA-CR(P)-2650; ETN-88-93246) Avail: NTIS HC A04/MF A01

An ESL nickel-cadmium battery model was extended to match the battery manufacturer's steady state cycling characteristics, and to increase the temperature range over which the model is valid. The model was validated by comparisons with test results in the ambient temperature range 0 to 20 C. Less confidence must be attached to results produced by the model outside the 0 to 20 C range, there being no battery cycling data outside this range with which to judge model performance. ESA

N89-11996# Ecole Centrale de Lyon (France). Lab. de Physicochimie.
STUDY OF OXIDE INFLUENCE ON THE ELECTRICAL PROPERTIES OF ELECTRONIC DEVICES BASED ON INDIUM PHOSPHATE Ph.D. Thesis [L'ETUDE DE L'INFLUENCE DES OXYDES SUR LES PROPRIETES ELECTRIQUES DES COMPOSANTS ELECTRONIQUES EN PHOSPHURE D'INDIUM]
Abdelhakim Mahdjoub 1988 195 p In FRENCH
(ECL-88-07; ETN-88-93258) Avail: NTIS HC A09/MF A01

The InP oxides, obtained electrolytically or by NO3H chemical oxidation were studied in order to analyze the feasibility of implementing with them in MIS electronic devices. The influence of the oxides on the InP/insulator interface was also studied. An MIS structure controlled by photoluminescence was assembled. It is shown that the oxidation product of a composition near In(PO3)3 presents properties similar to those of the silicon-silica system. A low density of excitation states in the forbidden band allows the implementation of field effect transistors with large values of electron mobility. ESA

N89-11997# Institut National Polytechnique, Grenoble (France). Lab. de Genie Informatique.
A SUBSYSTEM OF GEOMETRIC INVESTIGATION AND OF EQUIVALENCE FOR VLSI INTEGRATED CIRCUIT DESIGN USING CAD TOOLS Ph.D. Thesis [UN SOUS-SYSTEME DE RECHERCHE GEOMETRIQUE ET D'EQUIVALENCE POUR LA CAO DE CIRCUITS INTEGRES VLSI]
Josette BergerToussan 1987 232 p In FRENCH; ENGLISH summary
(ETN-88-93259) Avail: NTIS HC A11/MF A01

A method for geometrical range searching based on quadtree hierarchy is studied. The hierarchical use of the union-find equivalence algorithm, for searching and updating electrical equivalences, is analyzed. An improved version of the adaptive quadtree, the mixed-quadtree, was developed and evaluated to optimize conventional tools such as design rule checkers and electrical extractors, and supply fast editing of VLSI designs. ESA

N89-11998# Institut National Polytechnique, Grenoble (France). Techniques de l'Informatique, des Mathematiques, de la Microelectronique et de la Microscopie Quanti
OPTIMIZATION AND SURFACE-VELOCITY TRADEOFF IN THE SYCO SILICON COMPILER Ph.D. Thesis [OPTIMISATION ET COMPROMIS SURFACE-VITESSE DANS LE COMPILATEUR DE SILICIUM SYCO]
Nourouddine Bekkara 1987 192 p In FRENCH; ENGLISH summary
(ETN-88-93260) Avail: NTIS HC A09/MF A01

High level organization and area/performance trade-off in the SYCO silicon compiler are studied. The SYCO is a silicon compiler for VLSI microprocessor-like circuits. Optimization is done by detection and compaction of concurrently executable statements. Area-performance tradeoffs are made by improving execution speed of the circuit while increasing its area and vice-versa. A set of transformations that could be performed on the description to make tradeoffs without changing the original behavior of the circuit to be designed are presented. A software package was developed to perform these transformations, and methods to measure the changes caused by the transformations were determined. The microprocessor examples given confirm the usefulness of the method. ESA

N89-11999# Institut National Polytechnique, Grenoble (France). Techniques de l'Informatique, des Mathematiques, de la Microelectronique et de la Microscopie Quanti
CONTRIBUTION TO THE VERIFICATION OF INTEGRATED CIRCUITS IN A MULTIVALUE ENVIRONMENT Ph.D. Thesis [CONTRIBUTION A LA VERIFICATION DES CIRCUITS INTEGRES DANS UN ENVIRONNEMENT MULTIVALUE]
Jean-Paul Caisso 1987 197 p In FRENCH; ENGLISH summary
(ETN-88-93261) Avail: NTIS HC A09/MF A01

The specifications of simulation, fault simulation, and test pattern generation tools for VLSI transistor-level circuits are studied. The verification of MOS switch networks is performed directly, using special tools to overcome the lack of direction information. The states which represent the signal characteristics must be chosen in order to model all the specific behaviors of the switch level.

The state algebra is multiple-valued, and contains value-strength pairs, where the value represents the voltage and the strength represents the current of the signal. ESA

N89-12000# Institut National Polytechnique, Grenoble (France). Lab. de Genie Informatique.
FIDEL: A DESCRIPTION AND SIMULATION LANGUAGE FOR VLSI CIRCUITS Ph.D. Thesis [FIDEL: UN LANGAGE DE DESCRIPTION ET DE SIMULATION DES CIRCUITS VLSI]
El Tahawy Hazem 1987 319 p In FRENCH; ENGLISH summary
(ETN-88-93262) Avail: NTIS HC A14/MF A01

The concepts and properties of Hardware Description Languages (HDL) are discussed. The HDL FIDEL variant is presented. This language allows the functional and structural description and simulation of VLSI circuits. The basic characteristics of the language conform to a hierarchical multilevel simulation. Simulation tools built around FIDEL are described. An evaluation of different description languages is made. ESA

N89-12001# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
LOW NOISE MICROWAVE OSCILLATORS WITH GaAs MESFET, GaAlAs TEGFET, AND SILICON BIPOLAR TRANSISTOR. MODELING, CHARACTERIZATION, AND COMPARISON Ph.D. Thesis - Toulouse Univ.
Christian Utard 1988 164 p In FRENCH; ENGLISH summary
(LAAS-88-155; ETN-88-93286) Avail: NTIS HC A08/MF A01

A simplified large signal modeling method is presented for the MESFET, the TEOFET, and the bipolar transistor. The only nonlinearity considered is the transconductance or the current gain. Three methods to predict the electrical characteristics of a feedback oscillator are compared to simulation and experimental results. A study of transistor and oscillator low frequency noise and FM noise is presented to determine the more efficient active device. An LF noise to FM noise conversion coefficient is found and discussed. The MESFET is shown to be the most efficient active device for the applications presented. ESA

N89-12002# Federal Aviation Agency, Atlantic City, N.J.
AIRCRAFT ELECTRICAL WET-WIRE ARC TRACKING Final Report
Patricia L. Cahill and James H. Dailey Aug. 1988 24 p
(DOT/FAA/CT-88/4) Avail: NTIS HC A03/MF A01

Electrical wet-wire arc tracking is a phenomenon that has been known for many years. This can occur when leakage currents on a wet insulation surface are great enough to vaporize the moisture, resulting in the formation of dry spots. These dry spots offer a high amount of resistance to current flow. In turn, an induced voltage will develop across these spots and result in the occurrence of small surface discharges. Initially, these discharges will appear as scintillations at the insulation surface. These discharges produce highly localized temperatures on the order of 1000 C. Temperatures of this magnitude will cause thermal degradation of the insulation material, the nature of which depends on the insulation material used. The FAA conducted a series of bench scale tests which demonstrated that the ability of an aircraft wire to resist wet arc tracking and possible flashover is highly dependent on the composition of the wire insulation. In addition, the conductivity level of the electrolyte may influence the time and type of failure (arc track or open circuit) that can occur. Author

N89-12212# Nokia Research Center, Espoo (Finland).
FEM SIMULATION MODEL FOR SIGNAL DELAY IN GENERAL DISTRIBUTED NETWORKS
Veikko Hara *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 13-24 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N89-12003*# Wisconsin Univ., Milwaukee. Dept. of Mechanical Engineering.
HIGHER ORDER TURBULENCE CLOSURE MODELS Report, Apr. - Sep. 1988
Ryoichi S. Amano, John C. Chai, and Jau-Der Chen 3 Oct. 1988 80 p
(Grant NAG8-617)
(NASA-CR-183236; NAS 1.26:183236) Avail: NTIS HC A05/MF A01 CSCL 20D

Theoretical models are developed and numerical studies conducted on various types of flows including both elliptic and parabolic. The purpose of this study is to find better higher order closure models for the computations of complex flows. This report summarizes three new achievements: (1) completion of the Reynolds-stress closure by developing a new pressure-strain correlation; (2) development of a parabolic code to compute jets and wakes; and, (3) application to a flow through a 180 deg turnaround duct by adopting a boundary fitted coordinate system. In the above mentioned models near-wall models are developed for pressure-strain correlation and third-moment, and incorporated into the transport equations. This addition improved the results considerably and is recommended for future computations. A new parabolic code to solve shear flows without coordinate tranformations is developed and incorporated in this study. This code uses the structure of the finite volume method to solve the governing equations implicitly. The code was validated with the experimental results available in the literature. Author

N89-12004 Stanford Univ., Calif.
HIGHER-ORDER BOUNDARY-LAYER SOLUTION FOR UNSTEADY MOTION OF A CIRCULAR CYLINDER Ph.D. Thesis
Soonil Nam 1988 93 p
Avail: Univ. Microfilms Order No. DA8808396

The higher-order boundary-layer solution for an impulsively moving circular cylinder with uniform velocity and an exponentially accelerating cylinder in incompressible, relatively high Reynolds number flow of short duration is considered. A perturbation method is employed to linearize the two-dimensional vorticity equation by a double series expansion with respect to the Reynolds number and the time. A matched asymptotic expansion is carried out to define the proper boundary conditions between the viscous and inviscid layers for the linearized first-, second-, and third-order boundary-layer equations. Singularities appear in the viscous displacement velocities and skin frictions in the higher-order approximate solutions which coincide with the singularity of the first-order approximate solution. These singularities have alternating signs and increasing magnitudes, so attempt to remove the effects of the singularity of the lower-order solution. However, this attempt at removing a singularity by superposing even stronger singularities makes the solution worse around the singularity, and the boundary-layer assumptions break down at that point. Dissert. Abstr.

N89-12005# Creare, Inc., Hanover, N.H.
NUMERICAL MODELING OF FLOW THROUGH ORIFICE METERS Topical Report, Jul. 1986 - Aug. 1987
M. Z. Sheikholesiami and B. R. Patel Mar. 1988 53 p
(Contract GRI-5086-271-1269)
(PB88-208822; CREARE-TM-1160; GRI-87/0315) Avail: NTIS HC A04/MF A01 CSCL 20D

Numerical modeling is performed for turbulent flow through orifice meters using Creare's computer program FLUENT. FLUENT solves the time averaged Navier-Stokes equations in 2-D and 3-D

Cartesian or cylindrical coordinates. Turbulence is simulated using a two equation k-epsilon or algebraic stress turbulence model. It is shown that an 80 x 60 grid distribution is sufficient to resolve the flow field around the orifice. The variations in discharge coefficient are studied as a result of variation in beta ratio, Reynolds number, upstream and downstream boundary conditions, pipe surface roughness, and upstream swirl. The effects of beta ratio and Reynolds number on the discharge coefficient are shown to be similar to the experimental data. It is also shown that the surface roughness can increase the discharge coefficient by about 0.7 percent for the range of roughness heights encountered in practice. The numerical modeling approach would be most effective if it is combined with a systematic experimental program that can supply the necessary boundary conditions. It is recommended that numerical modeling be used for the study of other flow meters. GRA

N89-12006# Sandia National Labs., Albuquerque, N. Mex. Fluid and Thermal Sciences Dept.
FOAM RHEOLOGY: A MODEL OF VISCOUS EFFECTS IN SHEAR FLOW
Andrew M. Kraynik and Douglas A. Reinelt (Southern Methodist Univ., Dallas, Tex.) 1988 4 p Presented at the 10th International Congress on Rheology, Sydney, Australia, 14 Aug. 1988
(Contract DE-AC04-76DP-00789)
(DE88-005733; SAND-87-2053C; CONF-880827-4) Avail: NTIS HC A02

Foams consisting of gas bubbles dispersed in a continuous network of thin liquid films display a remarkable range of rheological characteristics that include a finite shear modulus, yield stress, non-Newtonian viscosity, and slip at the wall. Progress in developing micromechanical theories to describe foam rheology has depended upon two-dimensional models, which in most cases are assumed to have perfectly ordered structure. Princen accounted for surface tension and geometrical effects, and analyzed the nonlinear elastic response of a spatially periodic foam in simple shear. His analysis has been extended to account for more general deformations. Khan and Armstrong and Kraynik and Hansen have proposed ad hoc models for viscous effects in foam rheology. Their models capture numerous qualitative phenomena but incorporate relaxation mechanisms based upon overly simplified assumptions of liquid flow in the thin films. Mysels, Shinoda, and Frankel considered soap films with interfaces that are inextensible due to the presence of surfactants. They analyzed the primary flow that occurs when such films are slowly withdrawn from or recede into essentially static junction regions such as the Plateau borders in a foam. Adopting this mechanism, Schwartz and Princen considered small periodic deformations of a foam and calculated the energy dissipation due to viscous flow in the thin films. In the following, we also adopt the basic interfacial and viscous mechanisms introduced by Mysels et al. and analyze simple shearing deformations of finite amplitude. The configuration and effective stress of the foam are determined. Under these deformation conditions, the foam is a nonlinear viscoelastic material. Results for the uniform expansion of a foam are also presented. DOE

N89-12007# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst. Nizkikh Temperatur.
BOILING HEAT TRANSFER IN A FLAT SLOT BETWEEN HEATING SURFACE AND PERFORATED PLATE
Yu. A. Kirichenko, K. V. Rusanov, and E. G. Tyurina 1987 19 p In RUSSIAN; ENGLISH summary
(DE88-702882; INIS-SU-22) Avail: NTIS (US Sales Only) HC A03/MF A01

The results are presented of the experimental study of heat transfer and crisis at nitrogen boiling in a flat gap between the horizontal heating surface and perforated plate. The gap width is 1.0 to 5.6 mm, diameter of holes is 1.0 to 2.0 mm, their spacing being 3.0 to 12.0 mm. The geometrical parameters dependence of the heat transfer coefficient and crisis characteristics is investigated, and experimental data are compared with the results reported by other authors and calculations by some well-known formulas. DOE

N89-12008# Illinois Univ., Urbana.
TWO-PHASE STEADY DETONATION ANALYSIS
J. M. Powers, D. S. Stewart, and H. Krier 1987 21 p Presented at the 11th International Colloquium on Dynamics of Explosions and Reactive Systems, Warsaw, Poland, 3 Aug. 1987
(Contract W-7405-eng-36)
(DE88-012957; CONF-870868-1) Avail: NTIS HC A03/MF A01

Steady solutions to a set of two-phase reactive flow model equations are studied to test the hypothesis that observed deviations from Chapman-Jouguet (CJ) detonation states in porous solid propellants are manifestations of the two-phase nature of the flow. Shock jump relations are presented. A simple expression for a minimum detonation wave speed analogous to a CJ detonation for a single phase is given. The analogous CJ point is a sonic point. In the appropriate limit the minimum detonation velocity varies linearly with initial bulk density, and the corresponding detonation pressure varies with the square of initial bulk density. Non-ideal gas effects play an important role in determining CJ conditions. The effect of reaction zone structure is studied to determine its effect on detonation end states. DOE

N89-12009# Virginia Univ., Charlottesville. Dept. of Applied Mathematics.
NUMERICAL METHODS FOR FLUID FLOW PROBLEMS Progress Report
L. E. Mansfield Jul. 1988 16 p
(Contract DE-FG05-87ER-25031)
(DE88-014732; DOE/ER-25031/1; UVA/527356/AM89/101)
Avail: NTIS HC A03/MF A01

During the past year research was done on the solution on multiprocessors of linear systems of equations arising from finite element of finite difference discretizations of partia. DOE

N89-12010*# Detroit Diesel Allison, Indianapolis, Ind.
IMPROVED NUMERICAL METHODS FOR TURBULENT VISCOUS FLOWS AEROTHERMAL MODELING PROGRAM, PHASE 2 Final Report
K. C. Karki, S. V. Patankar, A. K. Runchal, and H. C. Mongia Jun. 1988 93 p
(Contract NAS3-24350)
(NASA-CR-182169; EDR-13519; NAS 1.26:182169) Avail: NTIS HC A05/MF A01 CSCL 20D

The details of a study to develop accurate and efficient numerical schemes to predict complex flows are described. In this program, several discretization schemes were evaluated using simple test cases. This assessment led to the selection of three schemes for an in-depth evaluation based on two-dimensional flows. The scheme with the superior overall performance was incorporated in a computer program for three-dimensional flows. To improve the computational efficiency, the selected discretization scheme was combined with a direct solution approach in which the fluid flow equations are solved simultaneously rather than sequentially. Author

N89-12011# Visual Aerodynamics, Torrance, Calif.
AN INNOVATIVE APPROACH TO NONINTRUSIVE QUANTITATIVE MEASUREMENTS OF VORTEX FLOWS Final Report, Jan. - Dec. 1987
Gerald N. Malcolm, Liane C. Lewis, Bert F. Ayers, and Daniel M. Goldfarb Feb. 1988 43 p
(Contract F49620-87-C-0069)
(AD-A196629; AFOSR-88-0403TR) Avail: NTIS HC A03/MF A01 CSCL 20D

A unique flow measurement technique was used to obtain quantitative vortex flow field data. This demonstration showed that a video based data acquisition system, Expertvision, could be used to measure the velocity of flow through some parts of the flow field. The system systematically tracks packets of colored dye ejected from the models into the surrounding flow fields and then subsequently reduces the data to position, velocity and acceleration measurements for individual vortex cores. Vortex core data were collected for 70 and 80 degree delta wing models with both stationary and forced roll oscillation roll conditions. GRA

N89-12012# Chemical Research and Development Center, Aberdeen Proving Ground, Md.
REACTION OF MICROPARTICLES BY THE DIFFUSION OF REACTIVE GASES THROUGH POROUS SHELLS Technical Report, Sep. 1986 - May 1987
Glenn O. Rubel and James W. Gentry Apr. 1988 25 p
(AD-A196656; CRDEC-TR-88076) Avail: NTIS HC A03/MF A01 CSCL 07D

A new experimental technique, single particle electrodynamic balance (SPEB), was used to study the heterogeneous reaction between single acid droplets and basic gases. Experiments with phosphoric acid droplets and ammonia gas show that the droplet reaction dynamics are sequentially controlled by surface phase, gas phase diffusion-controlled, and porous shell diffusion-controlled reactions. Gas phase diffusion-controlled reactions terminate when ammonium phosphate crystallizes at the droplet surface, and porous shell diffusion-controlled reactions become rate limiting. We derive a semiempirical model to describe the porous shell diffusion-controlled reactions of acid droplets with surface layers of crystallized solids. The model is parameterized with an effective porous shell diffusion coefficient to describe the transport of reactive gases through the porous shell. GRA

N89-12013# Southwest Research Inst., San Antonio, Tex.
PIPE FLOW MEASUREMENTS OF A TRANSPARENT NON-NEWTONIAN SLURRY
Joel T. Park, Richard J. Mannheimer, Terrence A. Grimley, and Thomas B. Morrow 1988 25 p Presented at the 4th International Symposium on Applications of Laser Anemometry to Fluid Mechanics, Lisbon, Portugal, 11 Jul. 1988
(Contract DE-FG22-86PC-90962)
(DE88-015042; CONF-880765-1) Avail: NTIS HC A03/MF A01

An experimental description of the flow structure of non-Newtonian slurries in the laminar, transitional, and full turbulent pipe flow regimes is the primary objective of this research. Experiments were conducted in a large-scale pipe slurry flow facility with an inside pipe diameter of 51 mm. The transparent slurry formulated for these experiments exhibited a yield-power-law behavior from cup viscometer measurements. The velocity profile for laminar flow from laser Doppler velocimeter (LDV) measurements had a central plug flow region, and it was in agreement with theory. The range of the transition region was narrower than that for a Newtonian fluid. The mean velocity profile for turbulent flow was close to a 1/7 power-law velocity profile. The rms longitudinal velocity profile was also similar to a classical turbulent pipe flow experiment for a Newtonian fluid; however, the rms tangential velocity profile was significantly different. DOE

N89-12014# University of Southern California, Los Angeles. Dept. of Mechanical Engineering.
FLUIDIZATION MECHANISMS IN SLURRY FLOWS Quarterly Report
Charles S. Campbell Aug. 1988 6 p
(Contract DE-FG22-86PC-90957)
(DE88-016833; DOE/PC-90957/T7) Avail: NTIS HC A02/MF A01

A transducer is developed to measure particle pressures independently from fluid pressure. Initially it was thought that particle pressure was the only path by which the fluidization mechanism could be determined. The particle pressure transducer has been described in previous reports. A secondary project was developed to test these transducers and use them to measure the particle pressures generated against the side walls of gas-fluidized beds. This was a way to gain experience with the particle pressure transducer while awaiting the delivery of the pump and other components for the slurry pipe loop. Earlier this year, there was great difficulty in gaining repeatable results from the experiments. The culprit turned out to be static charge buildup in the granular mass. Hence, steam was injected into the air stream to help dissipate the charge buildup. This produced a further source of error that was eventually traced to the fiberoptic displacement transducer inside the probe. It developed that the transducer was sensitive to humidity. It has been suggested that this reaction might be a byproduct of the absorption of water onto the sensing surface changes its optical properties and hence its output signal. DOE

N89-12015*# National Aeronautics and Space Administration, Washington, D.C.
LAMINAR BOUNDARY LAYER WITH MODERATE TURBULENCE OF THE INCOMING FLOW
V. S. Kosorygin, V. Ya. Levchenko, and N. F. Polyakov Oct. 1988 24 p Transl. into ENGLISH from Abstract 16-88/Inst. of Theoretical and Applied Mechanics, Siberian Dept. of USSR Academy of Sciences, Novosibirsk (USSR), 1988 p 2-29 Transl. by SCITRAN, Inc., Santa Barbara, Calif.
(Contract NASw-4307)
(NASA-TT-20381; NAS 1.77:20381) Avail: NTIS HC A03/MF A01

The structure of a flat plate's laminar boundary layer was studied in the presence of moderate turbulent perturbations. Pressure fluctuations in the incoming flow and vibrations of the plate's leading edge were also checked in the experiments. The evolution of the spectra of root-mean-square values for the pulsations of the longitudinal velocity component and, more specifically, for oscillations with certain fixed frequencies is traced in the boundary layer. It is shown that the structure of the flow is determined by the turbulent motion which occurs near the leading edge of the plate and its coexistence with three-dimensionally increasing Tollmien-Schlichting waves. Author

N89-12016# Missouri Univ., Rolla.
NATURAL AND MIXED CONVECTION ALONG SLENDER VERTICAL CYLINDERS WITH NONUNIFORM HEATING M.S. Thesis
Jeffrey J. Heckel 15 May 1988 141 p
(AD-A197530) Avail: NTIS HC A07/MF A01 CSCL 20M

This thesis presents an analytical study of laminar convective heat transfer along vertical slender cylinders. Chapter 2 covers the case of variable surface heating conditions of the form 9 sub w(x) = ax to the nth power for natural convection. Results are presented for Pr = 0.1, 0.7, 7, and 100 and for n = 0.5, -0.25, 0, 0.25, and 0.5. It is found that as the curvature parameter Lambda increases the local heat transfer coefficient increases for the range of n investigated. The local wall shear stress decreases for a given location x with increasing curvature. It increases with increasing x for a constant radius cylinder with n is less than or = 0, but may decrease for n is less than 0. It is also found that a higher value of n or Prandtl number resulted in a lower wall velocity gradient. However, as the curvature is increased, the effect of n and Pr on these values diminishes. Chapter 3 covers the entire range of buoyancy-assisted, mixed convection along a vertical slender cylinder for the case of variable wall temperature distribution. The buoyancy parameter chi is varied from zero for pure free convection to one for pure forced convection. It is found that for given values of Pr, n and chi, as the curvature parameter Lambda increases both the local wall shear stress and the local heat transfer coefficient increase. Higher values of n and Pr are found to lower the local wall shear stress and to raise the local Nusselt number, and the effect of n and Pr is found to lessen as the curvature parameter is increased. Average Nusselt numbers were calculated and correlation equations for the local and average Nusselt numbers are presented for both problems investigated. GRA

N89-12017# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
VELOCITY AND TURBULENCE DISTRIBUTIONS IN WALL SUBCHANNELS OF A ROD BUNDLE IN THREE AXIAL PLANES IMMEDIATELY DOWNSTREAM OF A SPACER GRID
K. Rehme Jun. 1988 74 p In GERMAN; ENGLISH summary
(KfK-4408; ISSN-0303-4003; ETN-88-93195) Copyright Avail: NTIS HC A04/MF A01

Mean velocity, wall shear stresses, and turbulence were measured in 2 wall subchannels (P/D=1.223; W/D=1.183) of a rod bundle of 4 parallel rods arranged in a rectangular channel for 3 axial planes. A spacer grid of the SNR-type was inserted in the rod bundle at ratios of distance between the spacer grid and the measuring plane and the hydraulic diameter of L/Dh=0.96, 0.49, and 0.25, respectively. The Reynolds number was Re=155,000. The results show that the distributions of the velocity and of the turbulence are completed governed by the spacer grid. The effects of the spacer grid increase with decreasing distance from the spacer grid. ESA

N89-12018# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

INVESTIGATION OF COHERENT STRUCTURES IN TURBULENT PIPE FLOW Thesis

Thomas Reinhardt Dec. 1987 107 p In GERMAN; ENGLISH summary
(MPIS-19/1987; ISSN-0436-1199; ETN-88-93210) Avail: NTIS HC A06/MF A01; Max-Planck-Inst. fuer Stroemungsforschung, Boettinger Strasse 6-8, 3400 Geottingen, Fed. Republic of Germany 26 Deutsche marks

Wall pressure fluctuations and velocity fluctuations were measured simultaneously in fully developed turbulent pipe flow. Results obtained using the method of conditional averaging show that characteristic velocity patterns correlate with high or low pressure peaks at the pipe wall up to 13 pipe diameters upstream of the pressure transducer. This effect is measured even in the jet leaving the pipe and throughout the whole pipe cross section. The dimensions of the associated streaky patterns scale slightly with the Reynolds number in streamwise direction and quite precisely with wall units in spanwise direction. ESA

N89-12019# Universitaet der Bundeswehr, Neubiberg (West Germany). Inst. fuer Stroemungsmechanik und Aerodynamik.

STATISTICAL SIMULATION OF TURBULENT FLOW AROUND A CUBE SUBJECTED TO FRONTAL FLOWS [STATISTISCHE SIMULATION DER TURBULENTEN UMSTROEMUNG EINES FRONTAL ANGESTROEMTEN WUERFELS]

H. Werner, F. Baetke (Technische Univ., Munich, West Germany), and H. Wengle 1988 28 p In GERMAN Sponsored by DFVLR, Cologne, Fed. Republic of Germany
(ETN-88-93215) Avail: NTIS HC A03/MF A01

Buildings aerodynamics is studied in the case of turbulent flow around a cube subjected to a frontal flow. Three dimensional Reynolds equations are numerically solved for the middle flow pattern where the global turbulence effect is examined by a double equation model. Numerical results are compared with experimental ones in two different cases: homogeneous flow with low turbulence ratio, and simulated atmospheric boundary layer with high turbulence ratio. ESA

N89-12020# Universitaet der Bundeswehr, Neubiberg (West Germany). Inst. fuer Raumfahrttechnik.

PROCEDURE FOR NUMERICAL SOLUTION OF MARANGONI CONVECTION IN A ROTATING LIQUID BRIDGE [EIN VERFAHREN ZUR NUMERISCHEN BERECHNUNG DER MARANGONI-KONVEKTION IN EINER ROTIERENDEN FLUESSIGKEITSBRUECKE]

Harald Eckstein 1987 41 p In GERMAN
(LRT-WE-9-FB(1987); ETN-88-93220) Avail: NTIS HC A03/MF A01

To examine the possibilities of production of materials in space laboratories, the flow pattern of rotating floating fusion zones is studied on the model of a liquid bridge. The effects of heating procedure on surface temperature and tension are analyzed in the case of rotational symmetric temperature distribution. For the numerical solution the constitutive equations and Navier-Stokes equations are resolved. ESA

N89-12021# Universitaet der Bundeswehr, Neubiberg (West Germany). Inst. fuer Luft- und Raumfahrttechnik.

MARANGONI CONVECTION IN ROTATING LIQUID SYSTEMS

Helmut F. Bauer 1988 177 p
(LRT-WE-9-FB-6(1988); ETN-88-93221) Avail: NTIS HC A09/MF A01

The influence of rotational speed upon the Marangoni convection in axially independent rotating liquid systems with a free surface and an angular temperature distribution was investigated. Under the action of rotation the vortices move in the direction of the centrifugal acceleration, and exhibit increased velocity distribution and a shifting of the nodal lines of the circumferential velocity component in the direction of the centrifugal acceleration. For cases with an outside free surface, additional vortices appear in a certain Bond-number range depending on the diameter ratio and the applied temperature distribution. Below and inside this range, the magnitude of the velocity distribution decreases, while above the increase of the velocities of the liquid is quite pronounced. This effect may indicate small rotation for crystal growth experiments, in order to minimize striations. ESA

N89-12022# Aeritalia S.p.A., Naples (Italy). Space Systems Group.

FLUID SCIENCE LABORATORY FOR COLUMBUS, EXECUTIVE SUMMARY

V. Defilippi Paris, France ESA 31 Mar. 1988 45 p
(Contract ESA-6805/87)
(SG-RP-AI-024; ESA-CR(P)-2649; ETN-88-93245) Copyright Avail: NTIS HC A03/MF A01

The role of the fluid science laboratory (FSL) on Columbus; FSL scientific objectives; and Columbus resources and interfaces to FSL are summarized. The FSL concept comprises a fully contained fluid facility, a partially contained fluid facility, a containerless fluid facility, and a convection controlled fluid facility; two double racks; non dedicated containers for fluids, and conditioning loops; fully automated working; diagnostic techniques; and possibilities to intervene when changing fluids, diagnostics, stimuli, or geometric environmental conditions. A power conditioning subsystem is necessary. A man tended free flyer option is also feasible. ESA

N89-12023# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

COMBINING CHARACTERISTIC FORMS OF BOUNDARY CONDITIONS AND CONSERVATION EQUATIONS AT BOUNDARIES OF CELL-CENTERED EULER-FLOW CALCULATIONS

J. W. Boerstoel 1 Apr. 1987 63 p Presented at the 8th AIAA Computational Fluid Dynamics Conference, Honolulu, Hawaii, 9-11 Jun. 1987 Sponsored in part by the Netherlands Agency for Aerospace Research, Delft, The Netherlands
(NLR-MP-87024-U; B8809137; ETN-88-93392) Avail: NTIS HC A04/MF A01

A numerical method to obtain the additional equations in Euler-flow calculations based on cell-centered schemes when the number of equations required to determine the flow-state evaluation at grid points half a mesh outside the flow domain exceeds the number of boundary-condition equations provided by characteristic theory, is presented. A layer of auxiliary cells on flow boundaries is introduced, and semidiscrete conservation equations for these cells are defined. The time variations of the state in these auxiliary cells at the boundary are transformed into characteristic form, and time variations of characteristic variables corresponding to incoming information from the boundary into the flow are replaced by boundary conditions for these time variations. The boundary equations so obtained are mapped back into a form with primitive variables, and numerically integrated in time. The characteristic boundary conditions are first-order differential equations for time variations at boundary points of characteristic variables. These equations may be chosen to express that given functions of the flow state on the boundary should asymptotically tend with time to prescribed steady-state values. ESA

N89-12024# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

CALCULATION OF THE BOUNDARY LAYER AROUND AN ELLIPSOID AT 10 DEG ANGLE OF ATTACK

J. I. vandenBerg, J. P. F. Lindhout, and B. vandenBerg 30 Apr. 1987 54 p Presented at the AGARD Working Group 10 Meeting,

London, England, 2-3 Apr. 1987
(NLR-MP-87026-U; B8809136; ETN-88-93394) Avail: NTIS HC A04/MF A01

Three-dimensional turbulent boundary layer calculations around a 1:6 prolate spheroid at an angle of attack of 10 deg are compared with measurements. The calculations and measurements agree very well except in the region near separation. The calculated open separation region is predicted too far towards the lee-side. Test runs with modified pressure distribution, prescribed edge stream angle, with and without prescribing symmetry lines, and several different choices of the constants in the turbulence model, lead to essentially the same results. It is suggested that the discrepancies may be due to the neglect of normal curvature terms in the equations. ESA

N89-12025# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
A SIMULATION ENVIRONMENT FOR THE NUMERICAL SIMULATION OF LIQUID-SOLID BODY DYNAMICS
M. E. S. Vogels 14 May 1987 48 p
(Contract NIVR-02306N)
(NLR-TR-87068-U; B8809803; ETN-88-93405) Avail: NTIS HC A03/MF A01

For computer aided engineering of satellites with large amounts of onboard liquid, analysis tools that simulate the behavior of the combination of the satellite and the liquid were examined. A technical concept for a simulation environment for the numerical simulation of liquid-solid body dynamics is presented. The simulation environment supports the structured approach of partitioning in which models for liquid motion and solid body motion are independent. ESA

N89-12026*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A HIGH HEAT FLUX EXPERIMENT FOR VERIFICATION OF THERMOSTRUCTURAL ANALYSIS
Herbert J. Gladden and Matthew E. Melis Dec. 1988 17 p
Presented at the Winter Annual Meeting of the ASME, Chicago, Ill., 28 Nov. - 2 Dec. 1988 Original document contains color illustrations
(NASA-TM-100931; E-4202; NAS 1.15:100931) Avail: NTIS HC A03/MF A01 CSCL 20D

A major concern in advancing the state of the art technologies for hypersonic vehicles is the development of an aeropropulsion system capable of handling the high heat fluxes during flight. The leading edges of such systems must not only tolerate the maximum heating rates, but must also minimize distortions to the flow field due to excessive blunting and/or thermal warping of the compression surface to achieve the high inlet performance required. A combined analytical and experimental effort to study the aerothermodynamic loads on actively cooled structures for hypersonic applications was established. A hydrogen/oxygen rocket engine was modified to establish a high enthalpy high heat flux environment. The facility provides heat flux levels from about 200 up to 10000 Btu/sq ft/sec. Cross flow and parallel flow regeneratively cooled model can be tested and analyzed by using cooling fluids of water and hydrogen. Results are presented of the experiment and the characteristics of the Hot Gas Test Facility. The predicted temperature results of the cross flow model are compared with the experimental data on the first monolithic specimens and are found to be in good agreement. Thermal stress analysis results are also presented. Author

N89-12027*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ASYMPTOTIC INDUCED NUMERICAL METHOD FOR THE CONVECTION-DIFFUSION-REACTION EQUATION Final Report
Jeffrey S. Scroggs and Danny C. Sorensen Oct. 1988 34 p
Prepared in cooperation with Argonne National Lab., Ill.
(Contracts NAS1-18605; DE-FG02-85ER-25001; W-31-109-eng-38; DE-AC05-84OR-21400; W-7405-eng-48; AF-AFOSR-0211-85; NSF PIP-84-10110)
(NASA-CR-181730; ICASE-88-60; NAS 1.26:181730) Avail: NTIS HC A03/MF A01 CSCL 20D

A parallel algorithm for the efficient solution of a time dependent reaction convection diffusion equation with small parameter on the diffusion term is presented. The method is based on a domain decomposition that is dictated by singular perturbation analysis. The analysis is used to determine regions where certain reduced equations may be solved in place of the full equation. Parallelism is evident at two levels. Domain decomposition provides parallelism at the highest level, and within each domain there is ample opportunity to exploit parallelism. Run time results demonstrate the viability of the method. Author

N89-12028*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLUID SPRAY SIMULATION WITH TWO-FLUID NOZZLES
Robert D. Ingebo [1988] 14 p Proposed for presentation at the 27th Aerospace Sciences Meeting, Reno, Nev., 9-12 Jan. 1989; sponsored by AIAA
(NASA-TM-101367; E-4406; NAS 1.15:101367; AIAA-89-0053) Avail: NTIS HC A03/MF A01 CSCL 20D

Two-phase interacting flow inside a two-fluid fuel atomizer was investigated and a correction of aerodynamic and liquid-surface forces with characteristic drop diameter was obtained for liquid-jet breakup in Mach 1 gas flow. Nitrogen gas mass-flux was varied from 6 to 50 g/sq cm sec by using four differently sized two-fluid atomizers with nozzle diameters varyig from 0.32 to 0.56 cm. The correlation was derived by using the acoustic gas velocity, V sub c, as a basic parameter in defining and evaluating the dimensionless product of the Weber (We) and Reynolds (Re) numbers. By using the definition of WeRe, it was found that the ratio of orifice diameter to Sauter mean drop diameter could be correlated with the dimensionless ratio WeRe and the gas to liquid density ratio. Author

N89-12029# Technische Hochschule, Aachen (West Germany). Mathematisch-Naturwissenschaftlichen Fakultaet.
REAL TIME HOLOGRAPHIC INVESTIGATION OF AN OSCILLATING FLOW OF WET AIR THROUGH A LAVAL NOZZLE Ph.D. Thesis [ECHTZEIHTHOLOGRAPHISCHE UNTERSUCHUNGEN EINER OSZILLIERENDEN STROEMUNG VON FEUCHTER LUFT IN EINER LAVALDUESE]
Wolfgang Hintze 1987 85 p In GERMAN
(ETN-88-93236) Avail: NTIS HC A05/MF A01

Periodic nozzle flow of supercritical heat supply is studied by real time holographic interferometry. Condensation process is continuously investigated in a wind tunnel. Global oscillating flow field density and cooling velocity effects are analyzed together with heat supply by condensation. Numerical analysis of interferograms permits the prediction of oscillating shock wave frequency and amplitude. ESA

N89-12030# Karlsruhe Univ. (West Germany). Fakultaet fuer Chemieingenieurwesen.
INVESTIGATION OF THE EFFECT OF WALL MATERIALS AND TUBE DIAMETER BY HEAT TRANSFER FROM HORIZONTAL TUBES TO BOILING LIQUIDS Ph.D. Thesis [UNTERSUCHUNG ZUM EINFLUSS DES WANDMATERIALS UND DES ROHRDURCHMESSERS AUF DEN WAERMEUEBERGANG VON HORIZONTALEN ROHREN AN SIEDENDE FLUESSIGKEITEN]
Matthias Siebert 1987 155 p In GERMAN
(ETN-88-93237) Avail: NTIS HC A08/MF A01

Heating surface materials like copper, brass, and stainless steel are studied for their heat transfer coefficient through tubes of 8 mm diameter. Refrigerants considered are R12, R113, R114, methane, and pentane. Heat transfer measurements are carried out in dependence on boiling pressure, liquid properties, bubble formation, and size and bubble deposit thickness on heat surfaces. Nucleate boiling is visualized and observed. ESA

N89-12031# Institut Franco-Allemand de Recherches, St. Louis (France).

TURBULENT BOUNDARY LAYERS IN HIGH SHOCK ENTHALPY FLOWS [TURBULENTE GRENZSCHICHTEN IN STROEMUNGEN HOHER STAUENTHALPIE]

G. Smeets 24 Nov. 1986 41 p In GERMAN
(ISL-R-129/86; ETN-88-93277) Avail: NTIS HC A03/MF A01

For plane boundary layers, a computational method is presented allowing numerical determination of flows with high shock enthalpies including temperatures to 2000 K and flow rates to 2000 m/sec. Main charactristics of boundary layers are analyzed including temperature and flow rate profiles, wall shear strain and thermal flux. By appropriate choice of the parameters this method is adapted also to boundary layers behind projectiles or to shock boundary layers. ESA

N89-12032# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Aerodynamique.

BUFFETING COMPUTATION BY A NUMERICAL METHOD INVOLVING VISCOUS-INVISCID UNSTEADY INTERACTIONS Final Report [CALCUL DU TREMBLEMENT PAR METHODE NUMERIQUE D'INTERACTION VISQUEUX-NON VISQUEUX INSTATIONNAIRE]

P. Girodroux-Lavigne and J. C. LeBalleur Apr. 1988 55 p In FRENCH
(Contract STPA-85-95-009)
(ONERA-RSF-3/3617-AY-012A; ETN-88-93316) Avail: NTIS HC A04/MF A01

Two dimensional complementary results concerning the NACA 0012 profile are presented. Buffeting phenomena were observed in previous experiments. The results of calculation and experiment are in good agreement, particularly on the prediction of the buffeting frontier in the Mach number-incidence plan. The integral unsteady method was tried to develop the three dimensional viscous solver. Computations to test the three dimensional integral method are presented. ESA

N89-12033# Technische Hogeschool, Delft (Netherlands). Faculty of Mathematics and Informatics/Computer Science.

A STABILITY PROBLEM IN THE THEORY OF FLOW THROUGH COLLAPSIBLE TUBES

J. W. Reyn and K. M. Sobczyk 1988 16 p
(Rept-88-36; B8823230; ISSN-0920-8577; ETN-88-93372) Copyright Avail: NTIS HC A03/MF A01

How wave propagation in the flow through a nearly cylindrical collapsible tube filled with an incompressible, inviscid fluid interacts with the flow in the upstream and downstream rigid segments of the hydraulic circuit in which the collapsible tube is mounted is studied. This leads to the study of eigenmodes of the classical wave equation satisfying unusual boundary conditions dictated by the matching of rigid and flexible parts of the circuit. The characteristic equation, determining the frequencies of the eigenmodes, is of a transcendental quasi-polynominal type and the location of its roots is analyzed. It appears that for subcritical flow (S less than 1) all eigenmodes are damped, whereas for supercritical flow (S greater than 1) also growing eigenmodes exist. Here S is the speed index, being the ratio V/C, where V is the fluid speed in the collapsible tube and C the speed of wave propagation. The analysis suggests that for subcritical flow the system is stable. ESA

N89-12034# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

APPLICATION OF PARTICLE IMAGE DISPLACEMENT VELOCIMETRY TO A CENTRIFUGAL PUMP

N. Paone, M. L. Riethmuller, and R. A. VandenBraembussche Mar. 1988 29 p
(Contract EEC-N-ST2-0255)
(VKI-TN-165; ETN-88-93534) Avail: NTIS HC A03/MF A01

Particle image displacement velocimetry was applied to the study of the complex unsteady flow field inside the diffuser of a centrifugal pump. The development and design of the optical system are discussed, together with the choice of suitable tracer particles and photographic equipment to achieve good quality images. Their processing and further data reduction are presented. The absolute and relative flow fields are considered. The flow characteristics are also studied in terms of vorticity field. ESA

N89-12035# Admiralty Research Lab., Teddington (England).

COMPARISON OF THE COMPOUND MATRIX AND ORTHONORMALISATION METHODS FOR CALCULATING THE STABILITY OF HEATED WATER BOUNDARY LAYERS

M. D. Thomas May 1988 15 p
(ARE-TM(UHA)-88505; BR106144; ETN-88-93564) Copyright Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

A fourth-order eigenvalue finder for calculating the stability of heated water boundary layers was developed from a sixth-order orthonormalization method. Comparisons were made with a fourth-order eigenvalue finder based on the compound matrix method, and the original sixth-order method. All the methods give similar results but there appear to be numerical problems at high values of surface overheat. ESA

N89-12215# Paris VI Univ. (France).

IRROTATIONAL AND WEAKLY IRROTATIONAL FLOWS

O. Pironneau *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 51-79 Prepared in cooperation with Institut National de Recherche d'Informatique et d'Automatique, Le Chesnay, France
(For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N89-12036 Columbia Univ., New York, N.Y.

BROAD BAND IMAGING WITH AN IMAGING GAS SCINTILLATION PROPORTIONAL COUNTER Ph.D. Thesis

Kenneth S. K. Lum 1987 245 p
Avail: Univ. Microfilms Order No. DA8809383

A large imaging gas scintillation proportional counter (LIGSPC) has been built and calibrated at the Columbia Astrophysics Laboratory. This instrument combines the good energy resolution of a gas scintillation proportional counter with the good spatial resolution of a multiwire proportional counter. We present experimental results obtained with this detector and interpret them in terms of the physical processes underlying its operation. A coded aperture mask whose pattern is based on a pseudorandom sequence has been tested with the LIGSPC. We discuss the effects that several physical design limitations have on the image deconvolution and compare analytical, simulated, and experimental results. Placed at the focal plane of a grazing incidence mirror and a coded aperture mask, the LIGSPC forms the basis of a broad band X-ray imaging spectrophotometer (BBXRIS) for the study of cosmic X-ray sources. We discuss the principles involved in the design of an experiment based on the BBXRIS concept and look at two specific examples, preparations for which are now underway. Dissert. Abstr.

N89-12037# National Bureau of Standards, Gaithersburg, Md. Center for Radiation Research.

NBS (NATIONAL BUREAU OF STANDARDS) MEASUREMENT SERVICES: CALIBRATION OF BETA-PARTICLE RADIATION INSTRUMENTATION AND SOURCES

J. S. Pruitt, C. G. Soares, and M. Ehrlich Apr. 1988 77 p
(PB88-201579; NBS-SP-250-21; NUREG-CR-4266; LC-88-600514)
Avail: NTIS HC A05/MF A01 CSCL 14B

In a project funded jointly by the National Bureau of Standards (NBS) and the Nuclear Regulatory Commission (NRC), NBS has developed a calibration facility for beta-particle instruments and sources used in radiation-protection dosimetry. Central to this facility are beta-particle and nearly monoenergetic electron beams characterized in terms of absorbed-dose rates to water and in terms of pulse-height distributions of beta-particle and electron spectra. The documentation utilizes material previously published or otherwise disseminated by members of the staff of the Ionizing Radiation Division of the Center for Radiation Research (CRR) of the NBS. After a description of the facility and the procedures, results are given of studies that led to the determination of absorbed-dose rates to water for the NBS beta-particle and nearly monoenergetic electron beams, and studies of the influence of source configuration on beta-particle and nearly monoenergetic electron spectra. GRA

N89-12038# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
FOUR-CHANNEL DIGITAL RECORDING SYSTEM OF SINGLE PROCESS FORM FOR STUDY OF SOLID PROPERTIES IN PULSED HIGH MAGNETIC FIELDS
N. A. Bessonova, G. A. Kapustin, E. A. Meleshko, A. G. Morozov, S. V. Olejnik, I. E. Ostashev, and Yu. Yu. Palkin 1987 24 p
In RUSSIAN
(DE88-702855; IAE-4426/14) Avail: NTIS (US Sales Only) HC A03/MF A01

The four-channel measurement system developed for high-efficiency digital recording and reproduction of the single and rare-recurrent process shape is considered. The 10-capacity bipolar analog-to-digital converter (ADC) with maximum frequency of quantization 10 MHz is used in the system. The measurement system is designed for carrying out investigations related to the effect of pulsed high magnetic fields on solids. Problems concerning the development of high-speed pulse signal recorders based on specialized ADC are considered. Short notices of measurement system operation at the installation for pulsed high magnetic fields are given. DOE

N89-12039*# Arizona Univ., Tucson. Optical Sciences Center.
THE ABSOLUTE RADIOMETRIC CALIBRATION OF THE ADVANCED VERY HIGH RESOLUTION RADIOMETER
Semiannual Report
P. N. Slater, P. M. Teillet, and Y. Ding Oct. 1988 41 p
(Grant NAG5-859)
(NASA-CR-183256; NAS 1.26:183256) Avail: NTIS HC A03/MF A01 CSCL 14B

An increasing number of remote sensing investigations require radiometrically calibrated imagery from NOAA Advanced Very High Resolution Radiation (AVHRR) sensors. Although a prelaunch calibration is done for these sensors, there is no capability for monitoring any changes in the in-flight absolute calibration for the visible and near infrared spectral channels. Hence, the possibility of using the reflectance-based method developed at White Sands for in-orbit calibration of LANDSAT Thematic Mapper (TM) and SPOT Haute Resolution Visible (HVR) data to calibrate the AVHRR sensor was investigated. Three diffrent approaches were considered: Method 1 - ground and atmospheric measurements and reference to another calibrated satellite sensor; Method 2 - ground and atmospheric measurements with no reference to another sensor; and Method 3 - no ground and atmospheric measurements but reference to another satellite sensor. The purpose is to describe an investigation on the use of Method 2 to calibrate NOAA-9 AVHRR channels 1 and 2 with the help of ground and atmospheric measurements at Rogers (dry) Lake, Edwards Air Force Base (EAFB) in the Mojave desert of California. Author

N89-12040# Gosudarstvennyj Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
HARDWARE AND SOFTWARE FOR TV MEASUREMENT TECHNIQUE STUDY
A. A. Gusak, Yu. B. Dubasov, V. N. Novikov, Yu. A. Romanov, E. V. Serga, A. V. Kharlamov, and Yu. S. Khodyrev 1987 22 p
In RUSSIAN; ENGLISH summary
(DE88-702860; IFVE-OP-87-122) Avail: NTIS (US Sales Only) HC A03/MF A01

Hardware and software which allow to build a model of TV measurement system, to study its parameters and to train measurement algorithms are considered. The capabilities of the complex offered are shown at the examples of TV systems for image analysis in microscopy, beam diagnostics and parameter measurements of the position sensitive photodetectors. DOE

N89-12041# EG and G Energy Measurements, Inc., Goleta, Calif.
DEVELOPMENTS IN MERCURIC IODIDE GAMMA RAY IMAGING
B. E. Patt, A. G. Beyerle, R. C. Dolin, and C. Ortale 1987 24 p
Presented at the 6th International Workshop on Compound Semiconductors for Room Temperature X-Ray and Nuclear Detectors, Davos, Switzerland, 14 Sep. 1987
(Contract DE-AC08-83NV-10282)
(DE88-014979; EGG-10282-2137; CONF-8709315-5) Avail: NTIS HC A03/MF A01

A mercuric iodide gamma-ray imaging array and camera system previously described has been characterized for spatial and energy resolution. Based on this data a new camera is being developed to more fully exploit the potential of the array. Characterization results and design criterion for the new camera will be presented. DOE

N89-12042# Lawrence Livermore National Lab., Calif.
HOLOGRAPHIC MEASUREMENT OF EJECTA FROM SHOCKED METAL SURFACES
Charles McMillan and Richard Whipkey 20 Jul. 1988 7 p
Presented at the 18th International Congress on High-Speed Photography and Photonics, Xian, People's Republic of China, 28 Aug. 1988
(Contract W-7405-eng-48)
(DE88-015446; UCRL-99265; CONF-8808103-1) Avail: NTIS HC A02

We describe a holographic system that measures the size distribution of particles ejected from a shocked lead surface at speeds up to 2.8 mm/microsec. Observed diameters range from 3 to 50 microns. The three-dimensional distribution of the particles permits inferences about the uniformity of their distribution and velocity. Comparison of the holographic results for the mass with those obtained using a momentum transfer technique show general agreement but indicate that further refinement of both techniques may be necessary. DOE

N89-12043# North Carolina Univ., Chapel Hill.
A HIGH RESOLUTION PROJECTION ELECTRON SPECTROMETERS Final Progress Report, 1978-1987
S. M. Shafroth 1988 27 p Presented at the 8th Conference on the Application of Accelerators in Research and Industry, Denton, Tex., 12 Nov. 1984
(Contract DE-AS05-78ER-06027)
(DE88-015780; DOE/ER-06027/T1; CONF-841117-55) Avail: NTIS HC A03/MF A01

The main emphasis of the work has been to study inner shell ionization processes. The signatures have been K X-rays or K Auger transitions. We have worked with semiconductor or Bragg X-ray spectrometers. Toward the end of the contract we concentrated on projectile electron spectroscopy. These topics and other atomic physics projects are described briefly in this progress report. DOE

N89-12044# Lawrence Livermore National Lab., Calif.
AN ALIGNMENT MONITORING SYSTEM FOR PINHOLE IMAGING EXPERIMENTS
F. A. Schumacher and C. H. Adams May 1988 11 p
(Contract W-7405-eng-48)
(DE88-016097; UCRL-53867) Avail: NTIS HC A03/MF A01

We have developed a simple instrument to accurately measure

misalignments between a pinhole imaging assembly and the radiation source it is designed to image. Intended for remotely controlled use in the diagnostic canisters employed in underground nuclear testing, the instrument consists basically of two components: a telescope with attached TV camera, rigidly mounted to the radiation source (the nuclear device being tested), and a target rigidly mounted to the pinhole assembly. When the source and pinhole assembly are final-aligned before the canister is lowered into the test hole, the telescope and target are similarly aligned so that the telescope's crosshairs are centered on the image of a pair of illuminated x-y scales on the target. Whatever misalignment occurs between the source and the pinhole assembly as a result of lowering the canister into the hole and filling the hole with stemming material will thus be reflected in a similar misalignment between telescope and target. This enables us to determine the relative translation and relative tilt the pinhole assembly has undergone with respect to the source. The absolute tilt of the pinhole assembly is determined from a supplementary measurement made with a pair of gravity-sensing electrolytic transducers mounted on the rear (upper side) of the target.
DOE

N89-12045# California Univ., Berkeley. Lawrence Berkeley Lab.
GERMANIUM BLOCKED IMPURITY BAND FAR INFRARED DETECTORS Ph.D. Thesis
Carolyn Sally Rossington Apr. 1988 127 p
(Contract DE-AC03-76SF-00098)
(DE88-016208; LBL-25394) Avail: NTIS HC A07/MF A01

The infrared portion of the electromagnetic spectrum has been of interest to scientist since the eighteenth century when Sir William Herschel discovered the infrared as he measured temperatures in the sun's spectrum and found that there was energy beyond the red. In the late nineteenth century, Thomas Edison established himself as the first infrared astronomer to look beyond the solar system when he observed the star Arcturus in the infrared. Significant advances in infrared technology and physics, long since Edison's time, have resulted in many scientific developments, such as the Infrared Astronomy Satellite (IRAS) which was launched in 1983, semiconductor infrared detectors for materials characterization, military equipment such as night-vision goggles and infrared surveillance equipment. It is now planned that cooled semiconductor infrared detectors will play a major role in the Star Wars nuclear defense scheme proposed by the Reagan administration. DOE

N89-12046# Indiana Univ., Bloomington. Dept. of Chemistry.
A NEW FLUORESCENCE SENSOR FOR QUANTIFICATION OF ATMOSPHERIC HUMIDITY
Chu Zhu, Frank V. Bright, Wayde A. Wyatt, and Gary M. Hieftje
11 Jul. 1988 20 p
(Contract N00014-86-K-0366)
(AD-A197497; AD-E501007; INDU/DC/GMH/TR-88-35) Avail: NTIS HC A03/MF A01 CSCL 04A

A new fiber optic sensor (optrode) for humidity has been developed. The sensor utilizes a fluorescent dye entrapped within a perfluorinated ionomer matrix. The fluorescence intensity increases strongly and linearly with increasing water-vapor partial pressure even though the lifetime of the optrode is approximately 1 second and the presence of CO2 has no detectable effect on the determination of humidity. Apparently, the immobilized fluorescent dye, rhodamine 6G, associates with water to form a complex with a higher absorptivity. The dependence of fluorescence lifetime on emission wavelength revealed the co-existence of multiple excited states for the water-dye system. GRA

N89-12047# Washington Univ., Seattle. Lab. for Chemometrics.
MULTI-ORDER CALIBRATION Technical Report No. 40
Eugenio Sanchez and Bruce R. Kowalski 1 Jul. 1988 17 p
(Contract N00014-75-C-0536)
(AD-A197534) Avail: NTIS HC A03/MF A01 CSCL 14B

Instruments that generate two-dimensional arrays of data are now commonplace in the analytical laboratory. Time decay and emission-excitation fluorescence, chromatography-spectroscopy combinations, MS-MS and 2D-NMR, are a few of the many so-called hyphenated methods that generate such data. These instruments have become very important for the analyst mainly because of their higher selectivity and resolution of signals, allowing for analysis of mixtures. The main similarity between all these instruments is that each sample analyzed produces a two-dimensional array of data (second order tensor). The amount of information produced by such an instrument is overwhelming; for quantitative analysis usually only a small portion of the data is actually used and the rest discarded. This paper will summarize a multi-order, tensorial approach to calibration, that takes advantage of all the information from instruments that produce data arrays of any order, for prediction of unknown properties such as analyte concentrations. GRA

N89-12048* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS PARTICLE RADIATOR Patent
Donald L. Chubb, inventor (to NASA) 13 Sep. 1988 5 p
Filed 9 Oct. 1986 Supersedes N87-15452 (25 - 07, p 905)
(NASA-Case-LEW-14297-1; US-Patent-4,770,232; US-Patent-Appl-SN-917125; US-Patent-Class-165-41; US-Patent-Class-165-904; US-Patent-Class-126-443; US-Patent-Class-126-901) Avail: US Patent and Trademark Office CSCL 14B

A gas particle radiator adapted to operate in a microgravity space environment having a transparent boundary which transmits energy in the infrared spectrum, and a gas particle mixture that yields high absorption and emittances are described.
Official Gazette of the U.S. Patent and Trademark Office

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N89-12049 Maryland Univ., College Park.
EXPERIMENTAL DEMONSTRATION OF AN ELECTROMAGNETICALLY-PUMPED FREE-ELECTRON LASER WITH CYCLOTRON HARMONIC IDLERS Ph.D. Thesis
Richard Alan Kehs, Jr. 1987 156 p
Avail: Univ. Microfilms Order No. DA8808567

A new type of electromagnetically-pumped, three wave free electron laser was observed in which cyclotron harmonic waves act as idlers. In this experiment, a powerful electromagnetic pump wave replaced the usual magnetostatic wiggler. The pump wave was generated by an intense relativistic electron beam driven backward wave oscillator. A grating spectrometer was used to scan the microwave frequency spectrum from 50 to 130 GHz and powerful high-frequency radiation was observed in the form of an array of regularly spaced peaks. The results exhibit excellent agreement with a simple theoretical model of the three-wave interaction. Dissert. Abstr.

N89-12050# Sandia National Labs., Albuquerque, N. Mex.
REACTIVE ION ETCHING OF LASER STRUCTURES
G. Allen Vawter 1988 12 p Presented at the Advances in Semiconductors and Superconductors: Physics and Device Applications, Newport Beach, Calif., 13 Mar. 1988
(Contract DE-AC04-76DP-00789)
(DE88-008470; SAND-88-0913C; CONF-880311-2) Avail: NTIS HC A03/MF A01

In recent years interest in dry-etch processing of laser structures has grown dramatically. Reactive-ion-etching (RIE) has developed from a high resolution pattern transfer technique for silicon integrated circuit processing into a successful method for fabricating the smooth, vertical facets required by double heterostructure (DH) lasers. However, in addition to RIE several other new plasma processes have been developed and applied to the development of dry etched laser structures. This paper reviews the motivations behind this work, provides some examples of recent developments in the field of dry-etching as applied to DH laser structures and attempts to point out some of the problems associated with dry etching of optoelectronic devices. DOE

N89-12051 Stanford Univ., Calif.
LINAC STRUCTURE DESIGN FOR HIGH BRIGHTNESS BEAMS FOR FREE ELECTRON LASERS Ph.D. Thesis
Carl Ernest Hess 1988 126 p
Avail: Univ. Microfilms Order No. DA8808371

Several issues in the design of linear accelerator structures are examined in the context of producing electron beams for free electron lasers. Among the issues discussed are: accelerator structure requirements of harmonic acceleration; advantages of short, high gradient, low impedance, superconducting structures; interactions of an electron beam with structure modes, with particular attention given to anomalously trapped modes and regenerative beam breakup; and finally, acceleration gradient limitations in the proposed structures. Results and analysis of tests of two prototype structures are also presented. Dissert. Abstr.

N89-12052# Sandia National Labs., Albuquerque, N. Mex.
TARGET FABRICATION OF CURRENT PULSED-POWER DRIVEN X-RAY LASER TARGETS
D. K. Wiemann and K. W. Bieg 1988 10 p Presented at the 6th Target Fabrication Specialist's Meeting, Los Alamos, N. Mex., 19 Jun. 1988
(Contract DE-AC04-76DP-00789)
(DE88-012333; SAND-88-1729C; CONF-8806170-1) Avail: NTIS HC A02/MF A01

The goal is to make a pulsed-power driven X-ray laser. Ongoing experiments on the 10 TW, 5 MA accelerator, PROTO II, have required a wide range of thin-walled, hollow cylindrical targets called soda straws. A typical soda straw consists of an inner lasant layer, a Parylene strong back layer, and an outer converter layer. Variations to this have been targets of plain Parylene straws, straws with only lasant layers, and straws with only converter layers. These straws are nominally 1.6, 3, or 6 mm in diameter and 20 mm in length. Additional components to the straws have been solid cones coated with a lasant laser of vanadium mounted within the straws. Cone specifications are shown. The solid cones have a base diameter of either 3 or 6 mm and extend 2/3 the way up the straw with a tip radius of 127 microns. Target parameters for the straws have been the following: the inner coatings ranging from 100 to 1000 angstroms of vanadium, nickel, or copper; the Parylene thicknesses ranging from 1.8 to 5.0 microns, and the outer coatings ranging from 100 to 500 angstroms of silver or barium, 500 to 4000 angstroms of aluminum, or 2000 to 10,000 angstroms of sodium fluoride. The requirements for the cones have been 4000 angstroms and 400 angstroms of vanadium. DOE

N89-12053*# Hampton Inst., Va. Dept. of Physics.
DEVELOPMENT OF MID-INFRARED SOLID STATE LASERS FOR SPACEBORNE LIDAR Semiannual Progesss Report, 13 Apr. - 13 Oct. 1988
Donald A. Whitney and Kyong H. Kim 1988 36 p
(Grant NAG1-877)
(NASA-CR-183341; NAS 1.26:183341) Avail: NTIS HC A03/MF A01 CSCL 20E

This semiannual progress report covers work performed during the period from April 13, 1988 to October 13, 1988 under NASA grant number NAG-1-877 entitled, Development of mid-infrared solid state lasers for spaceborne lidar. We have designed a flashlamp-pumped Cr3(+);GSAG laser of pulsed laser energy greater than 200 mJ and of pulse width of 1 ms FWHM to simulate a high-power laser diode in pumping mid-infrared laser crystals such as Tm3(+), Er3(+), and/or Ho3(+)-ion doped YAG, YLF or other host materials. This Cr3(+);GSAG laser will be used to determine optimum conditions for laser diode pumped mid-infrared lasers, maximum energy extraction limit with longitudinal pumping, thermal damage limit, and other problems related to high power laser diode pumping. We have completed a modification of an existing flashlamp-pumped and liquid nitrogen cooled rare earth laser system for 60 J electrical input energy and a 500 micron pulse width, and have carried out preliminary experiments with a Ho(+):Er3(+):Tm3(+):YAG crystal to test the system performance. This flashlamp-pumped rare earth laser system will be used to determine optimum Tm3(+)-ion concentration in Ho3(+):Cr(+):-Tm3(+):YAG crystal in the remaining research period. Author

N89-12054# Michigan State Univ., East Lansing. Turbulence Structure Lab.
A STUDY OF TURBULENCE PRODUCTION USING A NEW PHOTOCHROMIC VISUALIZATION TECHNIQUE Annual Report, 1 Oct. 1986 - 1 Oct. 1987
R. E. Falco and C. C. Chu 28 Apr. 1988 158 p
(Grant AF-AFOSR-0047-87)
(AD-A196887; TSL-88-2; AFOSR-88-0614TR) Avail: NTIS HC A08/MF A01 CSCL 20D

The new technique of Laser Induced Photochemical Anemometry (LIPA) has been developed to enable measurement of the evolution of coherent structures involved in the turbulent production process. Results are reported showing the measurement of the streamwise and transverse vorticity component and the strain rate as well as the Reynolds stresses at large numbers of points in a chosen plane. Calibration depends only on a time and a length scale. Comparison of measurements with the exact solution in a Stokes' layer indicates that the technique's accuracy can be predicted by classical error analysis and that it is comparable or better than that achievable with the best single point probe techniques. The results show the relative importance of streaks, pockets and hairpins that are generated in the vortex ring/wall simulation of the turbulence production process. GRA

N89-12055# LTV Missiles and Electronics Group, Dallas, Tex. Missiles Div.
A NONLINEAR-OPTICAL METHOD FOR COMBINING HIGH POWER LASER BEAMS IN GASES OR PLASMAS Final Report
Jay S. Chivian, C. D. Cantrell, III, C. A. Glosson, W. D. Cotten, and S. F. DiMarco 31 May 1988 93 p
(Contract N00014-87-C-0114)
(AD-A196953; Rept-3-45400/8R-66) Avail: NTIS HC A05/MF A01 CSCL 09C

The purpose is to investigate concepts for laser controlled optics via near resonance nonlinear dispersion, so that a laser induced index grating which is capable of high power laser beam combining might be produced and demonstrated. The principle of coherent addition of several input laser beams into one output beam had been demonstrated by the use of binary phase gratings. Properly shaped phase gratings had been etched onto a solid surface, establishing that multiple laser beams can be combined into a single beam with good conversion efficiency. For high power beams, the limited damage thresholds and maximum permissible thermal loading of solid state devices encouraged a search for more satisfactory working media. Gases and plasmas appeared to offer better solutions as working media. It had been predicted that two laser fields of differing wavelengths interacting with a collision-dominated atomic or molecular system with three effective energy levels could influence one another in a nonreciprocal manner; the creation of and interaction with a grating via near-resonance nonlinear dispersion thus should provide a method for low power laser beams to create a grating in which other beams combined to form a high power beam. GRA

N89-12056# Sandia National Labs., Albuquerque, N. Mex.
EFFECT OF GASDYNAMICS ON RESONATOR STABILITY IN REACTOR-PUMPED LASERS
John R. Torczynski and Daniel R. Neal Jul. 1988 59 p
(Contract DE-AC04-76DP-00789)
(DE88-016863; SAND-88-1318) Avail: NTIS HC A04/MF A01

A number of experiments involving reactor pumping of atomic xenon have been conducted on Sandia reactors, with lasing observed at 1.73 microns and 2.03 microns for a variety of conditions. In some of these experiments, lasing was observed to terminate well before the peak of the pumping pulse. Recent advances in gasdynamic modeling and laser resonator stability theory make it possible to discriminate between laser kinetics and gasdynamics issues to explain these terminations for some experiments. In the February/March experiment series, lasing termination and/or reinitiation that can be attributed to gasdynamically induced resonator stability transitions was observed for some conditions. A laser resonator stability theory based on the existence of a parabolic refractive index profile in the gain medium is developed in terms of an index gradient strength parameter. The theoretically determined critical values of gamma (asterisk) for instability and restablization for the experimental configuration are in good agreement with gasdynamic computations of the gamma (asterisk) values at the experimentally observed termination and reinitiation times. DOE

N89-12057# Maryland Univ., College Park. Lab. for Plasma and Fusion Energy Studies.
QUANTITATIVE SPECTROSCOPY IN PULSED POWER DEVICES Report, 1 Apr. 1987 - 31 Mar. 1988
H. R. Griem 31 Mar. 1988 9 p
(Contract N00014-87-K-2019)
(AD-A197516) Avail: NTIS HC A02/MF A01 CSCL 09C

This report covers the second stage of an experimental research project directed towards the development of ultrashort wavelength lasers involving pulsed power devices rather than cylindrically focused high power lasers. During this second stage, modifications to the construction of the pinch source have been made, and a redesign of the pinch container and pumping mechanism with the aim of enhancing certain diagnostics has been undertaken. Diagnostic equipment has been procured, constructed, installed, and tested. In addition, a data acquisition system has been procured and is being installed. Further diagnostic equipment has been ordered. The experiment has progressed well into the developmental stage. GRA

N89-12058# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
STRAIGHT LINE CALIBRATION IN DRIFT CHAMBERS OVER 8 m
Fred Hartjes, Jan Konijn, and Yue Peng Nov. 1987 15 p
(NIKHEF-H/87-21; B8737918; ETN-88-93426) Avail: NTIS HC A03/MF A01

Results from a feasibility study of the use of UV nitrogen lasers for the alignment of a large system of stacked drift chambers are presented. They prove that a straight line calibration is possible over a distance of 8 m with deviations of less than 10 micron. The results could be reproduced by a computer simulation. ESA

N89-11973# Bell Telephone Labs., Inc., Holmdel, N. J.
ON 16 Gbit/s DIRECT MODULATION OF AN InGaAsP LASER
A. H. Gnauck and J. E. Bowers *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 205-206 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 09C

N89-11978# IBM Watson Research Center, Yorktown Heights, N.Y.
LASER PULSED E-BEAM SYSTEM FOR HIGH SPEED I.C. TESTING
Paul May, Jean-Marc Halbout, and George Chiu *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 220-222 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 09C

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N89-12059 Montana State Univ., Bozeman.
APPLICATION OF BOUNDARY INTEGRAL EQUATION METHOD TO TWO-DIMENSIONAL FRICTIONAL CONTACT PROBLEMS Ph.D. Thesis
Bhushan Wasudeo Dandekar 1987 219 p
Avail: Univ. Microfilms Order No. DA8803728

The boundary integral equation (BIE) technique is used to analyze the two-dimensional elastic contact problems with Coulomb friction. In this method, since only the boundary needs to be modeled, which contains the unkown contact zone, the data preparation time is considerably reduced. Also, since both tractions and displacements are retained as unkowns, the contact stresses are calculated directly. Navier's equations for the bodies in contact are transformed into simultaneous linear equations using the standard BIE technique. Results for several frictionless and frictional problems are presented. In the case of the frictionless problems the results are found to agree well with the analytical results. The frictional problems include an unloading problem and an advancing contact problem, for which no analytical solutions exist. In most cases, equal size linear elements are found to give best results. It is shown that in the presence of friction, the problem needs to be solved by applying the load in a large number of load increments or by computing the load increment sizes such that each node pair just barely comes in contact and then dividing these load increments into smaller ones. Dissert. Abstr.

N89-12060 Council for National Academic Awards (England).
HIGH-SPEED PERFORMANCE OF A HYDROSTATIC THRUST BEARING Ph.D. Thesis
David Ashman 1987 404 p
Avail: Univ. Microfilms Order No. BRD-80669

The high-speed performance of a multirecessed hydrostatic thrust bearing was studied to improve its performance. A theoretical analysis of the quasistatic behavior and isothermal frictional power consumption was developed using the basic equations governing viscous fluid flow. The effects of high peripheral speeds are discussed and how recently proposed bearing modifications, in the form of grooved lands and changes in recess geometry, are used to reduce the frictional power consumption, lower operating temperatures, and reduce unwanted hydrodynamic and fluid inertia induced pressure variations. The steady state temperature distribution, frictional power consumption and operating clearance when one bearing member is rotating, and dynamic loading of performance are predicted by several specially developed FORTRAN computer programs. Dissert. Abstr.

N89-12061 Clemson Univ., S.C.
ROBUST MANIPULATOR CONTROL USING ARM-WRIST PARTITIONING Ph.D. Thesis
Napoleon Hugo Ortiz 1987 200 p
Avail: Univ. Microfilms Order No. DA8803907

A manipulator control scheme which provides accurate tracking of the commanded trajectory and rejects a broad class of disturbances with minimal complexity and maximal reliability is presented. Existing techniques are either too complex for real time application or unable to respond appropriately to the presence of exogenous or endogenous disturbances. An analysis for partitioning a robot arm and wrist is developed using their kinematic and dynamic coupling. A conventional kinematic control approach is suggested for the wrist, while an arm control based on disturbance rejection is proposed. This control consists of a proportional and derivative control approach, complemented with a forward compensation loop for disturbance rejection. The forward loop uses a first order transfer function tuned for the disturbance bandwidth frequency range. Selection and justification of the first order system to model the expected disturbance is developed in the time and frequency domains. A Unimation/Westinghouse PUMA arm and the Clemson University CURBI robot simulation models were used for analysis study of the control strategy. Experimental

evaluation made on the CURBI robot showed good agreement with simulation results. The ability to compensate for disturbance effects was demonstrated for unloaded and loaded conditions.
Dissert. Abstr.

N89-12062 Clarkson Univ., Potsdam, N.Y.
UNBONDED CONTACT OF RECTANGULAR PLATES ON EDGE SUPPORTS OR ELASTIC FOUNDATIONS Ph.D. Thesis
Hui Li 1988 108 p
Avail: Univ. Microfilms Order No. DA8808026

This dissertation deals with the contact problems of unilaterally supported plates. The contact is assumed frictionless and tensionless. When loaded, the plate may bend away from the supports since there can be no tensile support reaction in the unilateral contact problem. The primary objectives are to find the contact regions, contact pressures and displacements for different combinations of loads and other plate and foundation parameters. Three relatively independent problems have been treated. The first problem is a rectangular plate on unilateral edge supports. The corners may lift up from the supports. The conditions of sagged supports and unsagged supports are both considered. The second problem is a Timoshenko beam (or an infinitely long strip) on an elastic layer. Shear deformation is included. The third problem is a thin square plate on an elastic half space. Diagrams are given for each case to show contact regions, contact pressures, and displacements. Comparisons are made with other work published in the literature. Dissert. Abstr.

N89-12063# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
CONTROL OF VIBRATION IN MECHANICAL SYSTEMS USING SHAPED REFERENCE INPUTS
Peter H. Meckl Jan. 1988 219 p
(Contracts N00014-86-K-0685; N00014-85-K-0124)
(AD-A196563; AI-TR-1018) Avail: NTIS HC A10/MF A01 CSCL 09A

Dynamic systems which undergo rapid motion can excite natural frequencies that lead to residual vibration at the end of the motion. This work presents a method to shape force profiles that reduce excitation energy at the natural frequencies in order to reduce residual vibration for fast moves. Such profiles are developed using a ramped sinusoid function and its harmonics, choosing coefficients to reduce spectral energy at the natural frequencies of the system. To improve robustness with respect to parameter uncertainty, spectral energy is reduced for a range of frequencies surrounding the nominal natural frequency. An additional set of versine profiles are also constructed to permit motion at constant speed for velocity-limited systems. These shaped force profiles are incorporated into a simple closed-loop system with position reference for the controller to follow. GRA

N89-12064# Dartmouth Coll., Hanover, N.H. School of Engineering.
THERMOMECHANICAL CONTACT PHENOMENA AND WEAR OF SLIDING SEAL COMPONENTS Annual Report, 1 Jan. - 31 Dec. 1987
Francis E. Kennedy, Jr., Beda M. Espinoza, and Susanne M. Pepper 30 Mar. 1988 40 p
(Contract N00014-87-K-0125; Proj. RR0-2403)
(AD-A197513) Avail: NTIS HC A03/MF A01 CSCL 11A

The objectives of this investigation were to better understand the tribological behavior of ceramic-coated rings sliding against carbon graphite and the thermocracking that occurs with some of the ceramic coatings. Sliding wear tests were conducted on Inconel 625 substrates coated with four different hard materials: chromium oxide, chromium carbide, titanium nitride, and tungsten carbide. Tests were also run to determine the corrosion behavior of the ceramic-coated rings in seawater. Surface profilometry, mass loss measurements, and microscopy were used to characterize wear, cracking and corrosion phenomena. Coupled with the experimental work was a theoretical analysis of temperatures and stresses in the contact region of the ceramic coating during sliding. The influence of various material and geometric parameters on coating cracking was studied in the analytical work. GRA

N89-12065# MATRA Espace, Paris-Velizy (France).
SERVICE VISION SUBSYSTEM (SVS)
Paris, France ESA 8 Feb. 1988 19 p Original contains color illustrations
(Contract ESTEC-6495/85-NL-PB(SC))
(ESA-CR(P)-2643; ETN-88-93172) Copyright Avail: NTIS HC A03/MF A01

A service vision subsystem (SVS) for a spaceborne service manipulator (SMS) system was defined. The SVS functions are: proximity sensory function involving camera sensor and requiring image processing capabilities in order to deliver information requested by the control unit; and potential image preprocessing (compression) requested by the telemeasure and telecommand subsystem. The types of image processing are related to the operation to perform. For basic functions, SVS acts as a proximity sensor for the automatic control of the SMS, and as an imaging device (including image compression) for inspection. Extended functions include enhancement of the image, and feature extraction for improving the monitoring and teleoperation; and SVS as a 3-D sensor for less favorable conditions (unlit targets, nonmarked targets, etc.). The basic functions were studied and implemented on the SVS breadboard. The extended functions were studied, requirements analyzed, and algorithms simulated. ESA

N89-12066# Ecole Centrale de Lyon (France). Lab. de Technologie des Surfaces.
LUBRICATED FRICTION OF ZIRCONIUM Ph.D. Thesis [FROTTEMENT LUBRIFIE DE LA ZIRCONE]
Philippe Maurin-Perrier 1987 191 p In FRENCH
(ECL-87-23; ETN-88-93255) Avail: NTIS HC A09/MF A01

The friction and wear behavior of zirconium in the presence of different lubricating agents was studied, and the wear mechanisms analyzed. A model of the wear evolution is developed. The friction/wear meter was of a sphere-plane type where the zirconium was the plane. The wear surface was studied by optical and electron microscopy. It is verified that the use of lubricants allows to avoid the wear observed on dry treatment. The analysis of lubrication with a silicon base shows that ceramic wear is due to the creation, in the contact zone, of degraded products from the lubricant itself, in the form of agglomerated spherical particles.
ESA

N89-12067# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
CONTRIBUTION TO THE STUDY OF STATIC AND VIBRATORY BEHAVIOR OF PARALLEL AXES SPUR GEARS, USING SPECKLE AND HOLOGRAPHY TECHNIQUES Ph.D. Thesis [CONTRIBUTION A L'ETUDE DU COMPORTEMENT STATIQUE ET VIBRATOIRE DES ENGRENAGES A AXES PARALLELES A DENTURE DROITE PAR SPECKLE ET HOLOGRAPHIE]
Hacene Belhaneche 1988 148 p In FRENCH Sponsored by the Algerian government
(IDI1-88-06; ETN-88-93283) Avail: NTIS HC A07/MF A01

The displacements of gear teeth were measured using speckle and holographic interferometry. Results show that the visualization of vibration modes by average time holography is feasible. The analysis of the torsion mode indicates that the node line passes through the teeth in contact. The dependence of the resonant frequency on the type and intensity of the excitation is discussed.
ESA

N89-12068# Centre Technique des Industries Mecaniques, Senlis (France).
RESEARCH ON THE ORIGINS OF THE VIBRATIONS OF A DIESEL ENGINE Final Report [RECHERCHE DES SOURCES VIBRATOIRES D'UN MOTEUR DIESEL]
G. Lovat Jun. 1987 29 p In FRENCH
(CETIM-100970; ETN-88-93289) Copyright Avail: NTIS HC A03/MF A01

The participation of different phenomena in the generation of engine vibrations was studied. The phenomena considered included combustion, and movements of pistons, crankshaft, and valves. Tests were done either with a diesel engine charged by a brake, or dragged by an electric engine. The natural frequencies related to the investigated vibrations are between 4500 and 6000 Hz for valves, 1700 Hz for injection pumps, and 800 Hz for the combustion chamber. Harmonic vibrations caused by the work of the oil pump and the distribution gear are significant parts of the total vibration. ESA

N89-12069# Centre Technique des Industries Mecaniques, St. Etienne (France).
LUBRICATION IN HALF-HOT FORCING OPERATIONS Final Report [LA LUBRIFICATION DANS LES OPERATIONS DE FORGEAGE A MI-CHAUD]
P. Ravassard Feb. 1987 103 p In FRENCH Sponsored by the Ministere de la Recherche et de l'Enseignement Superieur, Paris, France
(CETIM-103020; ETN-88-93295) Copyright Avail: NTIS HC A06/MF A01

The lubrication products and application during the forging operation are studied. The analysis includes a theoretical approach and the study of the actual products available on the market from 15 producers. The products include graphite or white product suspension in different fluids. The ring test used to characterize the lubricant performance is described. The results show that the proposed selection criteria are efficient. The lubricant characteristics are listed. ESA

N89-12070# Centre Technique des Industries Mecaniques, Senlis (France).
OPENINGS IN FLAT BOTTOMS OF PRESSURE VESSELS Final Report [OUVERTURE DANS LES FONDS PLATS D'APPAREILS A PRESSION]
Jacques Magny Jul. 1986 28 p In FRENCH
(CETIM-103090; ETN-88-93296) Copyright Avail: NTIS HC A03/MF A01

Design methods for flat bottoms of pressurized vessels, which include openings, are presented. The description includes the design principles, the determination of the minimum thickness without holes, and the determination of the compensation coefficient to compensate the presence of openings. ESA

N89-12071# Centre Technique des Industries Mecaniques, Nantes (France).
APPLICATIONS OF FRICTION WELDING TO MECHANICAL ASSEMBLING. PART 1: METALLURGICAL STUDY AND PROCESS POSSIBILITIES Final Report [APPLICATION DU SOUDAGE PAR FRICTION AU MECANSOUDAGE. PREMIERE PARTIE: ETUDE SUR LA METALLURGIE ET LES POSSIBILITES DU PROCEDE]
R. Gaillard, P. Roguin, P. Ajon, and G. Allain (Institut de Soudure, Paris, France) 21 Jul. 1988 80 p In FRENCH
(Contract COREM-86-02)
(CETIM-104-190-Pt-1; IS-22-061-Pt-1; ETN-88-93298) Copyright Avail: NTIS HC A05/MF A01

Friction welded joint formation was analyzed by means of tests interrupted before the joint was made. Thermal cycle analysis and metallographic tests completed the investigation. The weldability of a set of high carbon tempering steels was also studied. Most of these steel specimens, except two, are sensitive to crack formation and propagation. Increasing the welding energy would allow welding of most of these steels. Postheating above the Ms point reduces most of the cracking. Tensile strength remains poor in all cases. ESA

N89-12072# Centre Technique des Industries Mecaniques, Senlis (France).
LEAK SEALS FOR ROTATING SHAFTS Final Report [ETANCHEITE JOINTS POUR ARBRES TOURNANTS]
Thanh Nguyen and L. Faure 24 Jun. 1987 117 p In FRENCH
(CETIM-14-L-074; ETN-88-93311) Copyright Avail: NTIS HC A06/MF A01

An experimental study was carried out to analyze the behavior of lip seals working on rotating shafts. A complete test bench was built. It is found that the roughness of the surface in contact with the shaft influences heating and wearing of the lip. The accuracy of shaft rectifying has an equivalent effect on seal life. Statistical parameters of leaking joints are analyzed. ESA

N89-11924# Sandia National Labs., Albuquerque, N. Mex.
FEEDBACK CONTROL OF GAS TUNGSTEN-ARC WELDING
In its Sandia Technology, Volume 11, No. 2 Dec. 1987 p 10-1 (For primary document see N89-11922 03-31)
Avail: NTIS HC A03/MF A01

N89-11925# Sandia National Labs., Albuquerque, N. Mex.
ELECTROFORMING: ART IN SCIENCE
In its Sandia Technology, Volume 11, No. 2 Dec. 1987 p 16-2 (For primary document see N89-11922 03-31)
Avail: NTIS HC A03/MF A01

N89-11926# Sandia National Labs., Albuquerque, N. Mex.
SCIENTIFIC ASPECTS OF WELDING
In its Sandia Technology, Volume 11, No. 2 Dec. 1987 p 22-2 (For primary document see N89-11922 03-31)
Avail: NTIS HC A03/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N89-12073# Centre Technique des Industries Mecaniques, Senlis (France).
NONDESTRUCTIVE TEST OF BONDED ASSEMBLIES. POSSIBILITIES OF ACOUSTIC EMISSION Final Report [CONTROLE NON DESTRUCTIF DES ASSEMBLAGES COLLES. POSSIBILITES DE L'EMISSION ACOUSTIQUE]
M. Cherfaoui Jan. 1987 65 p In FRENCH
(CETIM-101480; ETN-88-93291) Copyright Avail: NTIS HC A04/MF A01

A theoretical study of wave propagation in bonded joints and an experimental study of acoustic emission of specimens subjected to a controlled nondestructive stress were performed. The test specimens were partly defective. Results show that acoustic emission clearly indicates the presence or absence of defects, and correlations are found between the results of defect localization and fracture localization. ESA

N89-12074# Centre Technique des Industries Mecaniques, Senlis (France).
EXPLOITATION OF THE BARKHAUSEN EFFECT FOR THE NONDESTRUCTIVE DETERMINATION OF STRUCTURAL STATES OF STEELS AND THEIR MODIFICATIONS Final Report [EXPLOITATION DE L'EFFET BARKHAUSEN POUR LA DETERMINATION PAR VOIE NON DESTRUCTIVE DES ETATS STRUCTURAUX DES ACIERS ET LEURS MODIFICATIONS]
C. Flambard, A. Debus, and B. Vannes 1 Jun. 1988 202 p In FRENCH
(CETIM-15-H-377; ETN-88-93312) Copyright Avail: NTIS HC A10/MF A01

Theoretical quantitative models relating stress and microstructure states to the measures of ferromagnetic noise are developed. The analysis is used to implement measuring instruments and signal processing devices used for the systematic characterization of ferromagnetic materials differently treated and submitted to varying experimental conditions. The results show that the noise can be related to a combination of sources associated to properties such as grain size, microstructure, internal stress, and phase characteristics. ESA

N89-12075# Centre d'Essais Aeronautique Toulouse (France). Lab. d'Analyses non Destructives.
DEVELOPMENT OF AN EDDY CURRENT NONDESTRUCTIVE ANALYSIS METHOD, THE ELOTEST UL4, WITHOUT DISASSEMBLY OF FIXATIONS. TEST REPORT M7-614800 [MISE AU POINT D'UNE METHODE D'ANALYSE NON DESTRUCTIVE PAR COURANTS DE FOUCAULT ELOTEST UL4 SANS DEMONTAGE DES FIXATIONS. PROCES-VERBAL M7-614800]
11 Aug. 1987 51 p In FRENCH Sponsored by the STPA
(Rept-M7-614800; ETN-88-93322) Avail: NTIS HC A04/MF A01

A method was developed for the inspection of structural elements without disassembling. The results obtained on specimens from aircraft elements cover the adjustments of the method parameters, the study of the physical phenomena involved, and the evaluation of the defects found. The method described allows to visualize the evolution of cracks and to detect location. ESA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N89-12076 Illinois Univ., Urbana-Champaign.
APPLICATIONS OF THE OPTICAL METHOD OF CAUSTICS TO THE STUDY OF VISCOELASTIC DYNAMIC FRACTURE AND STATIS BLUNT CRACK FRONTS Ph.D. Thesis
Kevin Lee Dickerson 1987 113 p
Avail: Univ. Microfilms Order No. DA8803019

The opto-mechanical relation, as used in the optical methods of photoelasticity and caustics, are extended to linearly viscoelastic materials. The Maxwell-Neumann relation for the stress-optic constants, which is good for linearly elastic behavior, is replaced by an expression derived form the Clausius-Mosotti-Lorentz-Lorenz (CMLL) equation. The opto-mechanical relation is given explicitly in terms of the mechanical and dielectric properties of the materials. In the limiting case of elastic behavior, the present result is consistent with the Maxwell-Neumann relation. Approximations to the CMLL equation are discussed and compared with the experiment. The derived opto-mechanical relations are applied to the steady-state propagation of a crack in a viscoelastic material. Numerical computation of the caustic and initial curves are performed. Numerical calculations are used to determine the stress intensity factors of previously performed crack propagation experiments. In order to address the accuracy and validity of the experimental measurement of the stress intensity factor, the stress field for a static blunt crack tip is investigated. Dissert. Abstr.

N89-12077 City Univ., London (England).
FATIGUE STRENGTH PREDICTION OF ADHESIVELY BONDED UNIDIRECTIONAL CARBON FIBRE REINFORCED COMPOSITE JOINTS Ph.D. Thesis
William Pambid Tiu 1987 234 p
Avail: Univ. Microfilms Order No. BRDX80615

Fatigue strength prediction was carried out by a linearly elastic finite element analysis of three joint designs to find the maximum stresses at the stress concentrations. These stresses were then compared to the fatigue strength of the materials to predict the joint fatigue strength. Stress-endurance (S-N) curves for the joints were obtained experimentally. Fatigue failure initiated in the adhesive fillet in tension. The adhesive was fatigue tested to find the tensile S-N curve which was then used in the prediction for comparison with the calculated maximum tensile stress in the adhesive fillet. The most interesting result was that tensile not shear strength data for the adhesive was required to predict the fatigue strength of the joints in which the adhesive is normally regarded as being loaded in shear. Dissert. Abstr.

N89-12078 Texas Univ., Austin.
BOUNDARY ELEMENT ANALYSIS OF ELASTIC-PLASTIC CRACK GROWTH Ph.D. Thesis
Ting-Wen Wu [1987] 119 p
Avail: Univ. Microfilms Order No. DA8728669

A modified version of the incremental path independent integral delta T* proposed by Atluri et al., to characterize ductile fracture resistance is presented. This modified path independent integral, denoted by delta T sub M*, has the same properties as delta T* in that it characterizes the near tip singularity and reduces to an increment of the J integral when the material behavior is elastic. Furthermore, the delta T sub M* integral is less singular than delta T*, and hence has obvious computational advantages. A new boundary element formulation in two-dimensional plasticity is also presented. The new formulation uses a so-called traction-free fundamental solution so that the boundary integral equations converge in the normal sense rather than only in the Cauchy principal value sense, and more important, a formal differentiation of the boundary integral equations leads to a valid integral representation for the in-plane stress component on the boundary. Numerical simulations based on a set of experimental data were carried out to examine the role of delta T sub M* as a fracture parameter. Dissert. Abstr.

N89-12079 Clarkson Univ., Potsdam, N.Y.
NONLINEAR VIBRATIONS OF THREE-DIMENSIONAL MECHANISMS Ph.D. Thesis
Morad M. ElSawy 1988 337 p
Avail: Univ. Microfilms Order No. DA8808023

The development of a general method to analyze the nonlinear vibration of general 3-D mechanisms with geometric and material nonlinearities is presented. Whereas the current techniques depend mainly on linear analyses, where small deformations are assumed, and are limited to 2-D problems, the main objective here is to develop a method to include both geometric and material nonlinearities for 3-D mechanisms. The geometric description of a beam element is developed using four levels of approximation by imposing various simplifying assumptions. Also, the strain displacement relations are presented to the same levels of approximations. Material nonlinearity of the Romberg-Osgood type is used. The general equations of motion for flexible elements undergoing translational and rotational motion are formulated and combined for the entire flexible mechanism. A finite harmonic series is employed to solve the system of nonlinear equations, to obtain a steady state solution. The system is first solved using a quasi-static technique. Then these results are substituted back into the system and successive iterations are carried out to obtain the nonlinear results. A computer program is set up to analyze the vibrations of general mechanisms, both planar and spatial, with geometric and material nonlinearities. Dissert. Abstr.

N89-12080# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
DISLOCATION MODEL OF FRACTURE
L. M. Kull 1987 24 p In RUSSIAN
(DE88-703139; IAE-4436/9) Avail: NTIS (US Sales Only) HC A03/MF A01

Papers dealing with study on mechanisms of submicrocrack formation and propagation using dislocation representations are analyzed. Cases of brittle and ductile fracture of materials as well as models of dislocationless (amorphous) zone at the growing crack tip are considered. Dislocation models of fracture may be used when studying the processes of deformation and accumulation of damages in elements of nuclear facilities. DOE

N89-12081# Carnegie Inst. of Tech., Pittsburgh, Pa.
AN EFFICIENT METHOD FOR PREDICTING THE VIBRATORY RESPONSE OF LINEAR STRUCTURES WITH FRICTION INTERFACES. VOLUME 2: STEADY-STATE VIBRATIONS OF A 2-BODY SYSTEM WITH A FRICTIONAL INTERFACE Final Report, May 1983 - Oct. 1986
Enrigue Bazan-Zurita, Jacobo Bielak, and Jerry H. Griffin 4 Apr. 1988 74 p

(Contract F33615-83-K-2316)
(AD-A197022; R-86-158-Vol-2; R-86-159-Vol-2; AFWAL-TR-86-2119-Vol-2; R-86-160-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 21E

In recent years it has become increasingly clear that friction damping in joints can affect significantly the dynamic response of structures with friction interfaces. In this report, we analyze the steady-state harmonic response of a system consisting of two spring masses connected by a Coulomb-type friction joint, as the simplest example of structures of this type. Two reasons motivate this work: (1) the simple system can serve as a basis for gaining physical insight into the behavior of more complex systems, and (2) inasmuch as this problem can be solved exactly, the solution can be used to assess the accuracy of approximate methods developed for more general systems. The differential equations governing the motion of the system during slip, partial-slip or stuck conditions of the joint are formulated in dimensionless form in order to identify the parameters controlling the dynamic response and to obtain results that are applicable to a large number of cases. GRA

N89-12082# California Univ., Berkeley. Lawrence Berkeley Lab. Center for Advanced Materials.

TENSILE AND SHEAR BEHAVIOR OF ALLOYED Sn-Pb SOLDER JOINTS Ph.D. Thesis

L. K. Quan Aug. 1988 52 p
(Contract DE-AC03-76SF-00098)
(DE88-016661; LBL-25741) Avail: NTIS HC A04/MF A01

This study presents an investigation of three ternary additions to a near-eutectic Sn-Pb alloy: indium (In), bismuth (Bi), and antimony (Sb). The effects of these ternary additions on the microstructure and on the strength in tensile and shear loading conditions in a joint configuration were studied. DOE

N89-12083# Naval Civil Engineering Lab., Port Hueneme, Calif.

A PRELIMINARY STUDY ON FINITE ELEMENT-HOSTED COUPLINGS WITH THE BOUNDARY ELEMENT METHOD Technical Note, Oct. 1985 - Sep. 1986

J. V. Cox Apr. 1988 53 p
(AD-A197539; NCEL-TN-1783) Avail: NTIS HC A04/MF A01 CSCL 12B

This study investigated the theoretical and numerical basis of finite element-hosted couplings with the boundary element method (BEM). The emphasis of the study is on: (1) conceptually unifying the different coupling approaches, and (2) providing an algorithm to facilities future implementation. Overviews of both the indirect and direct boundary element formulations are included. The theoretical development of BEM stiffness matrices is limited to a physically intuitive derivation based on the indirect BEM. Discontinuity between finite element and boundary element regions is an inherent trait of the boundary element method; this behavior is not eliminated by simply matching the order of shape functions between the two methods. A discussion of the numerical implementation of BEM-formulated stiffness matrices addresses both the direct and indirect BEMs. The direct BEM is better suited in coupled solution approaches due to its simpler traction-displacement relationship. Algorithms are included which outline the calculations unique to obtaining a stiffness matrix from the BEM. GRA

N89-12084# Army Armament Research and Development Command, Dover, N. J. Close Combat Armaments Center.

COMPARISON OF COMPLIANCE RESULTS FOR THE WEDGE-LOADED COMPACT SPECIMEN Final Report

J. H. Underwood and J. C. Newman, Jr. Jul. 1988 15 p
(AD-A197567; ARCCB-TR-88028) Avail: NTIS HC A03/MF A01 CSCL 20K

Results of the ratio of stress intensity factor to crack mouth displacement as a function of crack length are presented for the wedge-loaded compact specimen. Comparisons are made between experimental compliance results, numerical results from collocation methods, and deep crack limit solution results. Applications are for crack arrest and stress corrosion cracking tests for metals and other materials under predominantly linear elastic conditions. GRA

N89-12085# Centre Technique des Industries Mecaniques, St. Etienne (France).

ULTRASONIC MEASUREMENT OF PRELOADED BOLTS USING WAVE PACKETS Final Report [MESURE ULTRASONORE PAR TRAINS D'ONDES DE LA PRECHARGE DANS LA BOULONNERIE]

A. Brand Dec. 1987 66 p In FRENCH
(Contract CETIM-84-0772)
(CETIM-101300; ETN-88-93290) Copyright Avail: NTIS HC A04/MF A01

A method to control the residual stress in bolted assemblies was developed. The method is based on the variation of the elastic constants when stress increases. The differential in sound propagation characteristics is detected. The excitation signal is a sinusoidal wave package rather than a pulse. Tests carried out at 5, 10, and 15 MHz show that best results are obtained at the higher frequencies and a liquid coupler. The absolute accuracy over a bolt lot is better than 4 percent. ESA

N89-12086# Centre Technique des Industries Mecaniques, St. Etienne (France).

DELAYED BREAKING AND FATIGUE PERFORMANCE OF ASSEMBLIES MADE WITH BORON STEEL BOLTS, HEAT TREATED CLASS 8-8 AND 12-9 Final Report [LA RUPTURE DIFFERE ET LA TENUE EN FATIGUE D'ASSEMBLAGES AVEC BOULONNERIE EN ACIERS AU BORE ET POUR TRAITEMENTS THERMIQUES DE CLASSE 8-8 ET 12-9]

A. Brand and B. Besset Jun. 1988 38 p In FRENCH Original contains color illustrations
(CETIM-102230; ETN-88-93293) Copyright Avail: NTIS HC A03/MF A01

The creep and fatigue breaking performance of assemblies made with boron steel bolts were compared to the results of the more expensive heat treated alloyed steel. The corrosion performance was also studied. The results show that the boron steel bolts are quite satisfactory, except for minor points such as corrosion with cathodic polarization in acid environment. ESA

N89-12087# Centre Technique des Industries Mecaniques, Senlis (France).

STUDY OF CRACK PROPAGATION IN REAL PIECES Final Report [ETUDE DE LA PROPAGATION DES FISSURES DANS LES PIECES REELLES]

C. Bouhelier, P. Cherry, and J. P. Deville Jul. 1987 43 p In FRENCH
(CETIM-106590; ETN-88-93303) Copyright Avail: NTIS HC A03/MF A01

A macroscopic measurement of propagation speeds in steel specimens was compared with a microscopic measurement of propagation speeds in specimens and pieces. Significant difference are found between macroscopic and microscopic results and also between the speeds measured in test specimens and real pieces. ESA

N89-12088# Centre Technique des Industries Mecaniques, Senlis (France).

COMPUTATION OF STRESS SINGULARITIES IN ADHESIVE JOINTS

Ph. Destuynder, Y. Ousset (Ecole Centrale des Arts et Manufactures, Chatenay-Malabry, France), and C. Stackler Jul. 1987 17 p Presented at the EUROMECH 227 Congress, St-Etienne, France, 31 Aug.-2 Sep. 1987
(CETIM-10.70.60; ETN-88-93308) Copyright Avail: NTIS HC A03/MF A01

A method based on the complementary energy approach is presented for computing singularities which can appear at corners in adhesive joints. An extension of the dual singular functions to bimaterials is formulated in order to evaluate stress intensity factors.

Numerical examples show the influence of the stiffness and the length of the adhesive on the singular behavior at corners. ESA

N89-12089# Centre Technique des Industries Mecaniques, St. Etienne (France).
STUDY OF POTENTIAL AND UTILIZATION CONDITIONS OF FATIGUE INDICATORS. PART 2: USE OF BONDED WIRE FOR THE DETECTION OF CRACK INITIATION Final Report [ETUDE DES POSSIBILITES ET DES CONDITIONS D'UTILISATION DES INDICATEURS DE FATIGUE. DEUXIEME PARTIE: DETECTION D'APPARITION DE FISSURE PAR FIL COLLE]
Jean Verot and Bernard Besset Dec. 1987 19 p In FRENCH
(CETIM-1-2A-43-2-Pt-2; ETN-88-93309) Copyright Avail: NTIS HC A03/MF A01

A method to detect cracks, based on the utilization of a copper wire was developed. A thin copper wire is fixed by bonding across the crack. The wire is broken and an infinite electric resistance appears when cracks develop. In the case of machine tools the signal occurs always before the tool breaking, so that a warning is given in time. ESA

N89-12090# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
A FINITE ELEMENT ANALYSIS OF CRACKS IN A THIN WALLED CYLINDER UNDER INTERNAL PRESSURE
E. Riks and P. J. denRijer 15 Jan. 1987 50 p Sponsored by the Netherlands Agency for Aerospace Programs, Delft, Netherlands
(NLR-TR-87021-U; B8817439; ETN-88-93379) Avail: NTIS HC A03/MF A01

Finite element models for the analysis of the behavior of longitudinal cracks in a pressurized thin walled cylindrical shell were defined with the STAGSC-1 finite element code and used to study the possibilities of an analysis of cracks present in stiffened cylinders. In contrast to the problem of a crack in a flat plate in tension, the problem of a crack in a cylinder is governed by geometrical nonlinear effects from the onset. This is clearly brought out by the analysis results. They show that for cracks with a large aspect ratio, the linear theory grossly overestimates the intensity of the crack tip singularity. The results also show that the finite element method holds considerable promise in this area of crack mechanics. This is illustrated by the solution of a problem which concerns a centrally cracked plate loaded in the post buckling range. ESA

N89-12091# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
STRESS CORROSION CRACKS IN ALUMINUM AIRCRAFT STRUCTURES
L. Schra Presented at the NCC'S Working Group Autumn Meeting on Stress Corrosion, 10 Oct. 1987 Jul. 1987 In DUTCH; ENGLISH summary Presented at the Autumn Meeting on Controlled Operating with Materials with Growing Stress Corrosion Cracks, 10 Jun. 1987 (For primary document see
(NLR-MP-87048-U; B8805849; ETN-88-93401) Avail: NTIS HC A03/MF A01

Characteristic features of stress corrosion cracks in high strength aluminum alloys are discussed. The potential usefulness of linear elastic fracture mechanics for predicting stress corrosion crack propagation in aluminum aircraft structures is considered. A procedure for extended service life of stress corrosion susceptible structural parts is given. ESA

N89-12092# Bundesanstalt fuer Materialpruefung, Berlin (West Germany).
[ACTIVITIES REPORT IN MATERIALS RESEARCH AND TESTING] Annual Report, 1987 [JAHRESBERICHT 1987]
Jun. 1988 239 p In GERMAN Original contains color illustrations
(ISSN-0341-0528; ETN-88-93197) Avail: NTIS HC A11/MF A01

Analysis of metals and metal structures; metal technology; materials mechanics and metal structures behavior; corrosion protection; mineral chemistry; construction; reactor safety; mineral and organic materials; fiber reinforced plastics; textiles; paper and polymers; wooden and biological materials testing; rheology; tribology; surface technology and materials optical properties; nondestructive testing; nuclear techniques applied to materials testing; and radiation protection are discussed. ESA

N89-12093# Southampton Univ. (England). Inst. of Sound and Vibration Research.
DEVELOPMENT OF DAMPING TREATMENTS SUITABLE FOR HIGH TEMPERATURE ENVIRONMENTS: LITERATURE REVIEW
L. C. Chow Jan. 1988 23 p Sponsored by the Central Electricity Generating Board, United Kingdom
(ISVR-TR-157; ETN-88-93548) Avail: NTIS HC A03/MF A01

Structural damping technology in electric power plants using gas and liquid pumping, granular materials, frictional damping, polymers, rubbers and elastomers, fibrous materials, ceramics, and enamels is reviewed. ESA

N89-12094# Southampton Univ. (England). Inst. of Sound and Vibration Research.
DYNAMIC RESPONSES OF A SAND COLUMN WITH A BOTTOM END EXCITATION
R. Y. Shen, L. C. Chow, and R. J. Pinnington Feb. 1988 55 p
(ISVR-TR-158; ETN-88-93549) Avail: NTIS HC A04/MF A01

Dynamic responses of a sand column with base excitation were studied. The driving point accelerance of different height sand column and the transfer accelerance at different levels of sand column were measured. The experimental results were compared with predictions. The predicted values were calculated using two different analytical models, one including the effect of changing modulus of elasticity with pressure. The agreement between the predicted and measured values is reasonably good. ESA

42 GEOSCIENCES (GENERAL)

N89-12095# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Mapping, Charting, and Geodesy Div.
GEOMAGNETIC AUTONOMOUS SHUTTLE-LAUNCHED PROBE WORKSHOP
M. G. McLeod, ed. and G. Daniel Hickman, ed. Jun. 1987 67 p Workshop held in Bay St. Louis, Miss., 12-14 Mar. 1986
(AD-A188583; NORDA-188) Avail: NTIS HC A04/MF A01 CSCL 08D

NORDA is currently developing a spaceborne magnetometer system to support DOD global geomagnetic mapping requirements. The system is called GASP (Geomagnetic Autonomous Shuttle-Launched Probe). A workshop is described which was held at NORDA from 12 to 14 March 1986 to discuss the scientific value of the GASP satellite. For individual titles, see N89-12096 through N89-12103.

N89-12096# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
DESCRIPTION OF GASP c43
Kuno Smits *In its* Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 5-11 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08D

Currently a worldwide aeromagnetic survey is conducted with a specially modified RP-3 aircraft, for conducting magnetic data. This method is very expensive, does not provide global coverage at required modeling densities, and does not provide data in politically inaccessible areas. To alleviate the deficiencies of the present system, the Navy directed NORDA to develop a spaceborne magnetometer system to support the global magnetic mapping requirements. The system is under development for deployment with NASA Small Self-Contained Payload Program (Get Away Special). The complete probe is being designed for placement inside the NASA GAS container located aboard the space shuttle. Preliminary analysis shows that the probe should probably be instrumented with a triaxial ring core fluxgate magnetometer and a scalar proton precession magnetometer. The primary power source will be battery supplied with possible solar cell augmentation for extending the probe's life cycle. The probe is further discussed. Author

N89-12097*# Ohio State Univ., Columbus.
PRESENTATIONS BY PARTICIPANTS (EDITED AND CONDENSED) **c46**
R. R. B. vonFrese *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 13-21 (For primary document see N89-12095 03-42)
(Grants NAGw-736; NSF DPP-83-13071)
Avail: NTIS HC A04/MF A01 CSCL 08G

The utility of Geomagnetic Automonous Shuttle-Launched Probe (GASP) for studying the earth's crust can be characterized in terms of lithospheric contributions by past satellite programs. In contrast to the POGO and MAGSAT satellites, GASP will orbit at a lower elevation to provide better resolved lithospheric magnetic anomalies for more detailed and improved geologic analysis. In the geological representation of satellite magnetic anomaly data, two current approaches can serve the analysis of GASP observations. When global scale coverage is available, spherical harmonic expansions of the observations may be utilized. When satellite elevation data is used, a useful and efficient approach is to determine the physical properties of an array of point equivalent sources by least squares matrix inversion of the observations, which will closely duplicate the observed field. An important preliminary step in the representation of satellite magnetic observations by either approach, is to register the data at constant elevation over uniform intervals of latitude and longitude. Further applications of GASP are discussed. Author

N89-12098# Newcastle Univ. (England).
WORKING GROUP REPORTS SUBMITTED BY GROUP CHAIRMEN FOLLOWING WORKSHOP **c46**
Frank J. Lewes *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 41 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08D

The scientific problems are described in the document, Magnetic Field Explorer, (Dec. 1985). To address these problems the orbit should be near polar; a sampling rate of one sample every 15 secs would give adequate spatial resolution for the core field. Two days of good vector data in magnetically quiet conditions would be sufficient. Even if only scalar (intensity) data were available, this would be a vast improvement on Project MAGNET, but it is not clear how good a field model could be produced. It is likely that GASP will measure only the intensity and not the direction of the geomagnetic field, and this leads to significant problems in using such measurements to estimate a model of the main fieldfield. Possible magnetometer options were discussed. Three-component fluxgate magnetometers might be the simplest, but previous experience of unpredictable baseline shifts suggests three component fluxgate. Some form of backup is strongly recommended. Suggestions are given. Author

N89-12099# National Geophysical Data Center, Boulder, Colo.
WORKING GROUP ON STUDIES OF THE LITHOSPHERE: RECOMMENDATIONS **c46**
David Hastings *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 42 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08D

A summary is presented on the conclusions of the working group concerned with studies of the lithosphere. Listed and briefly discussed are specific benefits of Geomagnetic Autonomous Shuttle-Launched Probe (GASP) to crustal anomaly modeling. The specific goals of the group are listed along with the specifications for the missions and recommendations for processing the acquired data. Data archiving, documentation, and availability is also briefly discussed. E.R.

N89-12100# Brown Univ., Providence, R. I.
CONTRIBUTIONS TO THE GASP WORKSHOP PROCEEDINGS (NOT PRESENTED ORALLY) **c43**
John F. Hermance *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 43-46 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08B

The earth's magnetic field at satellite altitudes not only has contributions from the earth's core and static magnetization in the lithosphere, but also from external electric current systems in the lithosphere and magnetosphere, along with induced electric currents flowing in the conducting earth. The author in 1982 assessed these last two conditions, the external time varying fields and their associated internal counterparts, which are electromagnetically induced. The group recommends a follow-on mission to MAGSAT for a better understanding of the internal/external field coupling problem. By doing so, the time base of the primary data set is extended. And by flying this mission during all local times, a unique opportunity is obtained to discriminate between the sources of the external field contribution, i.e., both the effects of ionospheric current systems and magnetospheic current systems can be studied. E.R.

N89-12101# Geological Survey, Dover, Del.
SIMULATION OF A SPINNING SPACECRAFT MAGNETOMETER **c19**
Z. Wang and J. C. Cain *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 47-51 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 22B

In a companion report, A Study of Accuracy Enhancement in Satellite Magnetic Modeling, it is shown that the maximum fitting error in scalar field modeling could be dramatically reduced to a level of 140 nT in component field, or of the order of 0.2 degrees in declination, when a small quantity of vector data within some 10 degrees of the dip equator was added. A promising option to acquire the desired vector data is to employ the proposed spinning magnetometer system, a simpler and less costly device than the oriented spacecraft concept. One aspect of the spinning satellite idea is demonstrated. The preliminary results of the simulation studies prove optimistic, though further work needs to be done to detail its feasibility. Author

N89-12102# Geological Survey, Dover, Del.
A STUDY OF ACCURACY ENHANCEMENT IN SATELLITE MAGNETIC MODELING **c46**
Z. Wang and J. C. Cain *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 52-58 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08G

The purpose of this study was to examine geomagnetic field modeling options for the Geomagnetic Autonomous Shuttle-Launched Probe (GASP) project as presently conceived for mapping requirements, and to suggest ways that the product could be improved with little added expense. The assumption made is that GASP will collect data for a period of 6 to 10 days of the total scalar field of the earth in a near-polar orbit from low altitude. Future enhancements for obtaining a small amount of vector data in limited regions will also be addressed either with GASP in a spinning mode, or in a larger spacecraft. The addition of surface data will be investigated using observatory annual means. The first phase of the study involves the use of MAGSAT scalar and vector data. The second phase involves a combination of scalar satellite and surface data. The third phase involves determining whether a spinning spacecraft could make observation of the field perpendicular to the earth's rotation axis and that the axis and phase of the spin could be determined from the magnetic field observations. Author

N89-12103# Colorado Univ., Boulder.
SATELLITE MEASUREMENTS REQUIRED FOR DEEP-EARTH GEOPHYSICS **c46**
Edward R. Benton *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 59-60 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08G

Three major scientific issues arising within the less accessible, deeper parts of the earth can be phrased as the following questions: (1) What is the vertical profile of horizontally averaged electrical conductivity in the lower mantle (below the depths available to magnetotelluric sounding); (2) What is the intensity and pattern of the geomagnetic field (especially the vertical component) at the core-mantle boundary; and (3) What are the patterns of horizontal fluid motion in the outer core just beneath the core-mantle boundary. Answers to the first two questions are prerequisite to the thorough understanding of the geodynamo, that can only be started with an answer to question 3. Yet traditionally mantle conductivity is ignored in the downward extrapolation of surface magnetic measurements to the core-mantle boundary. The questions and some possible answers are briefly discussed. Author

N89-12104*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVED TIDAL BRAKING IN THE EARTH/MOON/SUN SYSTEM
D. C. Christodoulidis, D. E. Smith, R. G. Williamson, and S. M. Klosko (EG and G Washington Analytical Services Center, Inc., Lanham, Md.) Jul. 1987 81 p Previously announced in IAA as A88-41827
(NASA-TM-100677; Rept-87B0395; NAS 1.15:100677) Avail: NTIS HC A05/MF A01 CSCL 03B

The low degree and order terms in the spherical harmonic model of the tidal potential were observed through the perturbations which are induced on near-earth satellite orbital motions. Evaluations of tracking observations from 17 satellites and a GEM-T1 geopotential model were used in the tidal recovery which was made in the presence of over 600 long-wavelength coefficients from 32 major and minor tides. Wahr's earth tidal model was used as a basis for the recovery of the ocean tidal terms. Using this tidal model, the secular change in the moon's mean motion due to tidal dissipation was found to be -25.27 + or - 0.61 arcsec/century squared. The estimation of lunar acceleration agreed with that observed from lunar laser ranging techniques (-24.9 + or - 1.0 arcsec/century squared), with the corresponding tidal braking of earth's rotation being -5.98 + or - 0.22 x 10 to the minus 22 rad/second squared. If the nontidal braking of the earth due to the observed secular change in the earth's second zonal harmonic is considered, satellite techniques yield a total value of the secular change of the earth's rotation rate of -4.69 + or - 0.36 x 10 to the minus 22 rad/second squared. Author

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N89-12105# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Systems Development.
THE GVAR USERS COMPENDIUM, VOLUME 1
Keith McKenzie, ed., Raymond J. Komajda, ed. (Mitre Corp., Washington, D.C.), Carolyn Bradley, Earl Feigel, John Fiorello, Deborah Garr, Patrick Gerdes, Michael Jamieson, Donald Mack, and Jeffrey Shaffer et al. May 1988 205 p
(NOAA-NESDIS-21-Vol-1) Avail: NTIS HC A10/MF A01

The GEOS VARiable (GVAR) Users Compendium assumes reader familiarity with the GOES-I spacecraft and Ground Support Systems. Readers lacking this familiarity are advised to read NOAA Technical Report NESDIS 33, An Introduction to the GOES-IM Imager and Sounder Instruments and the GVAR Retransmission Format. Some sections assume an introductory knowledge of the GVAR format as well. It is the goal of this Compendium to cover a spectrum of issues of interest to the GOES direct readout user. While the editors have tried to convey a sense of cohesiveness, a totally cohesive document at the level of detail presented would take on encyclopedic proportions. The GOES I-M Ground System Project library contains over 1200 documents, ranging from 2-page memos to 300-page Interface Control Documents (ICDs) and grows at the rate of a dozen documents per week. This Compendium is a collection of excerpts from a variety of documents produced during the development of the GOES I-M spacecraft and ground systems. The information ranges from technical background material on the spacecraft instruments to current mission plans as GOES I becomes operational. Author

N89-12106# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AN AGRICULTURAL CROP YIELD MODEL BY SATELLITE: A SIMULATION [UMMODELO DE PRODUTIVIDADE AGRICOLA POR SATELITE: UMA SIMULACAO]
Fausto CarlosdeAlmeida, Corina daCostaFreitasYanasse, and Thelma Krug Aug. 1988 25 p In PORTUGUESE; ENGLISH summary Presented at the 2nd Latin American Symposium of Remote Sensing, Bogota, Columbia, 16-20 November 1987
(INPE-4639-PRE/1350) Avail: NTIS HC A03/MF A01

Variables derived from rainfall and sunshine are used in a crop yield model called the Method of Critical Periods proposed by Celaschi and Almeida and developed by Celaschi, aiming at the estimation of crop yields using satellite data. These variables, which can be extracted from environmental satellites, are simulated from conventional meteorological data gathered at the surface. The variables derived from rainfall are of the dummy type associated with the incidence of rainfall beyond a threshhold value, while the variable derived from sunshine hours is weighted by calk of rainfall, expressing the tendency for water stress. The model was tested for corn in the State of Sao Paulo, Brazil. The results are compared with those obtained by the conventional method employing temperature and rainfall and with the officially reported data for the state of Sao Paulo. Author

N89-12107# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DIGITAL PROCESSING APPLIED TO VEGETATION [PROCESSAMENTO DIGITAL APLICADO A VEGETACAO]
Flavio Jorge Ponzoni and Vitor CelsodeCarvalho Sep. 1988 25 p In PORTUGUESE; ENGLISH summary
(INPE-4695-MD/036) Avail: NTIS HC A03/MF A01

The main digital processing techniques of satellite imagery applied to the study of vegetation cover are presented in order to guide agricultural professionals interested in remote sensing studies. Research works concerned with these techniques are also presented. Author

N89-12108# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
METHOD OF VISUAL ANALYSIS OF REMOTE SENSING DATA-VEGETATION [METODOLOGIA DA ANALISE VISUAL DE DADOS DE SENSORIAMENTO REMOTO-VEGETACAO]
Pedro HernandezFilho Sep. 1988 25 p In PORTUGUESE; ENGLISH summary
(INPE-4696-MD/037) Avail: NTIS HC A03/MF A01

A methodology for visual analysis of remote sensing data is presented as applied to vegetative cover through the classical photointerpretation approach, i.e., tone, texture and form. Examples of vegetative targets and respective patterns in LANDSAT spectral

imagery are shown. Some examples of vegetation cover, such as cerrado, young and old eucalyptus reforestation, burnt and reforested areas are shown in TM-3, TM-4 and TM-5 imagery.
Author

N89-12109# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

INTERACTION OF SOLAR RADIATION WITH VEGETATION

Dalton MorissonValeriano Sep. 1988 35 p
(INPE-4697-MD/038) Avail: NTIS HC A03/MF A01

The acquisition of information about vegetation canopies by remote sensing has important applications in the fields of vegetation science, agronomy, geobotany, etc. The correct interpretation of this data from the reflected radiance measured by remote sensors demands knowledge of the interaction mechanisms of the electromagnetic radiation from a leaf as well as from the totality of elements that comprise the vegetation canopy. Some of the basic concepts of vegetation relevant to the understanding of the processes that determine the behavior of its spectral reflectance are discussed. Some methodological approaches to the study of these processes are also presented. Author

N89-12110# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

CROP SEPARATION ANALYSIS THROUGH SPOT AND TM DIGITAL DATA [SEPARABILIDADE DE CULTURAS ATRAVES DA ANALISE DIGITAL DE DADOS SPOT E TM]

Getulio TeixeiraBatista, Sherry Chou Chen, Antonio TebaldiTardin, and Jean Francois Dallemand Aug. 1988 15 p In PORTUGUESE; ENGLISH summary Presented at the 2nd Simposio Latino Americano de Sensoriamento Remoto, Bogota, Colombia, 16-20 Nov. 1987
(INPE-4641-PRE/1352) Avail: NTIS HC A03/MF A01

The objective of this paper was to evaluate SPOT and TM data for spectral discrimination of coffee, wheat, sugar cane, and pasturage in the Northwest of Parana State. The test site comprises a SPOT scene of approximately 60X60 km. Fifteeen fields were analyzed for each crop. Field information such as variety, planting date, phenological stage, row space, planting direction, percent soil cover, etc., was obtained. Wheat was originally considered as two classes according to its growth stage. Data were analyzed using one SPOT scene (5.3 deg off nadir, east viewing) acquired on July, 10, 1986, and one TM scene from August 2, 1986. J-M distance was calculated taking into account several classes and band combinations from both SPOT/HRV and LANDSAT-TM data. The best TM band combination for crop discrimination was determined. Separability analysis of crops using SPOT and TM images is presented. Author

N89-12111*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

REMOTE SENSING OF EARTH TERRAIN Semiannual Report, 1 Mar. - 31 Aug. 1988

J. A. Kong Aug. 1988 25 p
(Grant NAG5-270)
(NASA-CR-183347; NAS 1.26:183347) Avail: NTIS HC A03/MF A01 CSCL 08B

Two monographs and 85 journal and conference papers on remote sensing of earth terrain have been published, sponsored by NASA Contract NAG5-270. A multivariate K-distribution is proposed to model the statistics of fully polarimetric data from earth terrain with polarizations HH, HV, VH, and VV. In this approach, correlated polarizations of radar signals, as characterized by a covariance matrix, are treated as the sum of N n-dimensional random vectors; N obeys the negative binomial distribution with a parameter alpha and mean bar N. Subsequently, and n-dimensional K-distribution, with either zero or non-zero mean, is developed in the limit of infinite bar N or illuminated area. The probability density function (PDF) of the K-distributed vector normalized by its Euclidean norm is independent of the parameter alpha and is the same as that derived from a zero-mean Gaussian-distributed random vector. The above model is well supported by experimental data provided by MIT Lincoln Laboratory and the Jet Propulsion Laboratory in the form of polarimetric measurements. Author

N89-12112# Naval Postgraduate School, Monterey, Calif.

MARINE BOUNDARY LAYER DEPTH AND RELATIVE HUMIDITY ESTIMATES USING MULTISPECTRAL SATELLITE MEASUREMENTS M.S. Thesis

Steven P. Smolinski Mar. 1988 81 p
(AD-A196525) Avail: NTIS HC A05/MF A01 CSCL 04B

A technique is presented to estimate surface relative humidity and boundary layer depth from multispectral satellite measurements using the AVHRR sensor on TIROS-N generation satellites. A sensitivity study quantifies the effect of a combination of input measurement errors of sea-surface temperature, optical depth and total water vapor used in the technique to produce outputs of surface relative humidity and boundary layer depth under simulated conditions and model atmospheres. Technique verification is then accomplished with satellite data compared to ship and aircraft vertical soundings and sea-surface temperature measurements. The root mean square differences between the surface relative humidity/boundary layer depth satellite-measured estimates and verified measurements are 6 percent and 75 m respectively. Finally, synoptic-scale mapping of the surface relative humidity and boundary layer depth fields based on the satellite derived estimates is accomplished with monochromatic and color enhanced satellite images. Horizontal variability of surface relative humidity and boundary layer depth on the order of kilometers can be visually detected from these images. GRA

N89-12113# National Aerospace Lab., Amsterdam (Netherlands). Remote Sensing Dept.

THE POTENTIAL OF COMBINED USE OF SATELLITE DATA WITH TOPOGRAPHIC INFORMATION

F. B. vanderLaan 31 Aug. 1987 18 p Presented at the Willi Nordberg Symposium on Remote Sensing Towards Operational Cartographic Application, Graz, Austria, Sep. 1987
(NLR-MP-87061-U; B8815927; ETN-88-93402) Avail: NTIS HC A03/MF A01

Thematic Mapper, SPOT panchromatic, and SPOT Multispectral Scanner (MSS) imagery were investigated for their capabilities of keeping topographic maps up to date. Topographic information was digitally combined with satellite data using raster techniques. From the map line-information on roads, naming-conventions, water, and housing was used to cover a minimum part of the image and to obtain a maximum geographic reference structure in the imagery. A product with optimum characteristics was composed of a SPOT panchromatic band, a SPOT HRV infrared band, and a theme file with topographic information. The size of the file limits applications to manual procedures. Updating is limited to features of at least 4 m wide. The topographic overlay increases the user-friendliness of satellite data. Thematic information (on land use) can be combined with satellite imagery in a similar way as carried out with linear features. This can supply a highly detailed stratification of a region in functional classes, permitting classification procedures to achieve better results. ESA

N89-12114*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT-4 AND LANDSAT-5 MULTISPECTRAL SCANNER COHERENT NOISE CHARACTERIZATION AND REMOVAL

James C. Tilton and William L. Alford (Defense Mapping Agency, Washington, D.C.) Feb. 1988 46 p
(NASA-TP-2595-Rev; NAS 1.60:2595-Rev; Rept-86B0040) Avail: NTIS HC A03/MF A01 CSCL 08B

A technique is described for characterizing the coherent noise found in LANDSAT-4 and LANDSAT-5 MSS data and a companion technique for filtering out the coherent noise. The techniques are demonstrated on LANDSAT-4 and LANDSAT-5 MSS data sets, and explanations of the noise pattern are suggested in Appendix C. A cookbook procedure for characterizing and filtering the coherent noise using special NASA/Goddard IDIMS functions is included. Also presented are analysis results from the retrofitted

LANDSAT-5 MSS sensor, which shows that the coherent noise has been substantially reduced. Author

N89-12115 Deutsche Geodaetische Kommission, Munich (West Germany).
NEW CORRECTION MODEL FOR MICROWAVE REMOTE SENSING MEASUREMENT OF SATELLITES Thesis [EIN NEUES KORREKTURMODELL FUER MIKROWELLEN-ENTFERNUNGSMESSUNGEN ZU SATELLITEN]
Morteza Rahnemoon 1988 188 p In GERMAN
(Ser-C-335; ISBN-3-7696-9384-1; ISSN-0065-5325; ETN-88-93211) Copyright Avail: Fachinformationszentrum Karlsruhe, 7514 Eggenstein-Leopoldshafen 2, Fed. Republic of Germany

Error sources in satellite-Earth range electromagnetic measurements are investigated. Troposphere behavior is examined and its effect on optical and electromagnetic wave propagation is determined. The troposphere is studied in its dry and wet parts using ray tracing methods. Procedures are examined for ionospheric and tropospheric remote sensing error correction by modeling and water vapor radiometry. Accuracy and error sources are compared and the applications of each method are described. ESA

N89-12096# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
DESCRIPTION OF GASP
Kuno Smits *In its* Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 5-11 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08D

N89-12100# Brown Univ., Providence, R. I.
CONTRIBUTIONS TO THE GASP WORKSHOP PROCEEDINGS (NOT PRESENTED ORALLY)
John F. Hermance *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 43-46 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08B

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N89-12116# International Centre for Theoretical Physics, Trieste (Italy).
SILICON SOLAR CELL TECHNOLOGY STATE OF THE ART AND A PROPOSED DOUBLE SIDED CELL
Mohamad M. Seddik Aug. 1987 20 p
(DE88-702964; IC-87/247) Avail: NTIS (US Sales Only) HC A03/MF A01

A review of the silicon technology state of the art is given. It had been found that single crystal silicon efficiency was limitd to greater than or equal to 20 percent. The reason was identified to be due to the recombination current loss mechanisms. However, use of new technologies such as back-surface field, surface passivation, double anti-reflection coatings and back-surface illumination was demonstrated to achieve higher efficiencies. Experiments were carried out to evaluate the effect of back surfaces illumination on the cell efficiency enhancement. It was found that for single cell, back-surface illumination contribute a 12 percent increase in efficiency whereas for double cell illumination (back-to-back cells) the improvement was 59 percent increase in efficiency. A V-shaped flat mirror reflector with optimum angle of 45 deg. to the plane of the cell from both sides achieved the ultimate efficiency performance. Finally, a proposed high current - high efficiency solar cell called Double Drift - Double Sided Illumination Cell was presented. The new structures were in the form of n(+)pn(+) or p(+)np(+) double junctions. The expected efficiency ranges 50 to 60 percent with proper material design, double anti-reflection coatings and V-shaped irregular plane mirror reflector illumination. DOE

N89-12117# Sandia National Labs., Albuquerque, N. Mex.
ANALYSIS OF HEAT PIPE RECEIVERS FOR POINT-FOCUS SOLAR CONCENTRATORS
Douglas R. Adkins 1988 21 p Presented at the American Institute of Chemical Engineers Summer National Meeting, Denver, Colo., 21 Aug. 1988
(Contract DE-AC04-76DP-00789)
(DE88-014519; SAND-88-0093C; CONF-880850-3) Avail: NTIS HC A03/MF A01

Heat-pipe solar receivers are used to transfer concentrated solar energy from the focal point of a parabolic dish concentrator to the working fluid of a heat engine (or in some instances a chemical reactor). Concentrated solar energy that is collected on the front (absorber) surface of a heat pipe receiver is removed by the evaporation of an intermediate working fluid on the back side of the absorber surface. The vaporized fluid flows to the heater tubes of an engine where it condenses and transfers energy to the heat engine's working fluid. The condensed vapor then returns to the absorber surface where it is redistributed across the surface by a wick. Heat pipes are an attractive option for coupling solar concentrators to heat engines beacuse of their near isothermal operating characteristics and their ability to transfer large amounts of heat from relatively small surface areas. This paper investigates design factors that must be considered in constructing a solar heat pipe receiver. Particular emphasis is placed on designing a wick structure to transport the working fluid across the solar absorber surface, but general issues concerning fluid flow in heat pipe receivers are also presented. Analytical tools for the design of heat-pipe solar receivers are also provided. DOE

N89-12118# Minnesota Mining and Mfg. Co., St. Paul. Electronic and Information Sector Labs.
RESEARCH ON HIGH-EFFICIENCY, SINGLE-JUNCTION, MONOLITHIC, THIN-FILM AMORPHOUS SILICON SOLAR CELLS Final Technical Report, Feb. 1987
F. E. Aspen, D. P. Grimmer, R. L. Jacobson, F. R. Jeffrey, and N. T. Tran Jun. 1988 124 p Prepared for Midwest Research Inst., Golden, Colo.
(Contract DE-AC02-83CH-10093; ZB-4-03056-2)
(DE88-001177; SERI/STR-211-3344) Avail: NTIS HC A06/MF A01

Described is research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells in five task areas: a-Si materials; nonsemiconductor materials; a-Si solar cells; monolithic, intraconnected cells and submodules; and multichamber deposition systems. Researchers found that good film properties can be obtained at a deposition rate of 8 A/s using a 33 percent silane-in-hydrogen mixture; low-level phosphorous-doped a-Si:H films exhibit no detectable degradation with light soaking; and the p-window structure appears to be more stable than the n-window structure. The performance of such top contacts as SnO2/ITO, Ag/ITO, and SnO2/Ag/SnO2 was compared with that of single-layer ITO. A new web treatment system for a-Si solar cells was developed that reduces contamination from the web. Submodules with active areas of more than 70 sqcm were produced with active-area efficiencies of more than 4 percent. The fabrication technique involved laser scribing, screen printing, vapor deposition, and laser heat treatments. A multichamber deposition system was also designed and constructed that deposited a-Si p-i-n and n-i-p layers on a flexible polyimide web in a continuous, roll-to-roll deposition process. DOE

N89-12119# Oak Ridge National Lab., Tenn. Chemistry Div.
HYPEREUTECTIC HEAT STORAGE ALLOY: SILICON SHELL INTEGRITY IN MOLTEN Al-Si EUTECTIC Final Report

M. R. Bennett and J. Braunstein Jun. 1988 39 p
(Contract DE-AC05-84OR-21400)
(DE88-013352; ORNL/TM-10380) Avail: NTIS HC A03/MF A01

As a part of a program to evaluate the feasibility of using silicon encapsulated spheres of aluminum -silicon eutectic for thermal energy storage at temperatures near 650 degree C, experiments were done to test the dimensional stability of the interface between silicon and the eutectic to thermal cycling. Cycled samples were sectioned and examined by optical micrography and by electron microscopy techniques. Little or no degradation of the interface was observed at 600 C (eutectic temperature 577 C) while catastrophic degradation occurred at 700 C. At 650 C interpenetration of 0.1 endash 0.2 mm was observed between the silicon and the eutectic alloys, with occasional larger (3 to 4 mm) intrusions. DOE

N89-12120# Texas A&M Univ., College Station. Dept. of Chemical Engineering.

OXYGEN ELECTRODE IN MOLTEN CARBONATE FUEL CELLS Quarterly Technical Progress Report No. 1

P. K. Adanuvor, R. E. White, and A. J. Appleby 31 Oct. 1987 9 p
(Contract DE-FG22-87PC-79931)
(DE88-013715; DOE/PC-79931/1) Avail: NTIS HC A02/MF A01

The oxygen cathode of the molten carbonate fuel cell is still not well understood because of the uncertain nature of the reaction mechanism. The objectives of this project include a study to examine the kinetics of oxygen reduction in molten carbonate fuel cells by unambiguous methods that allow the determination of the rate setting steps and the reaction parameters. The data from such kinetic studies require sophisticated analytical techniques for obtaining the kinetic mechanism that best fits the data and, consequently, the best estimates of the reaction parameters. (1) A program has been written to simulate the reaction sequences for oxygen reduction in a molten carbonate fuel cell at a rotating disk electrode. (2) The reaction sequence for the superoxide mechanism was simulated using assumed and literature values for the reaction parameters. DOE

N89-12121*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

RESULTS OF THE 1988 NASA/JPL BALLOON FLIGHT SOLAR CELL CALIBRATION PROGRAM

B. E. Anspaugh and R. S. Weiss 1 Nov. 1988 39 p
(NASA-CR-182998; JPL-Pub-88-36; NAS 1.26:182998) Avail: NTIS HC A03/MF A01 CSCL 10A

The 1988 solar cell calibration balloon flight was successfully completed on August 7, 1988, meeting all objectives of the program. Forty-eight modules were carried to an altitude of 118,000 ft (36.0 km). The calibrated cells can now be used as reference standards in simulator testing of cells and arrays. Author

N89-12122*# Cleveland State Univ., Ohio. Dept. of Chemical Engineering.

MATHEMATICAL MODELING OF SOLID OXIDE FUEL CELLS Final Contractor Report

Cheng-Yi Lu and Thomas M. Maloney Aug. 1988 10 p
(Contracts NCC3-17; DE-AI21-80ET-17088)
(NASA-CR-182188; E-4319; DOE/NASA/0017-5; NAS 1.26:182188) Avail: NTIS HC A02/MF A01 CSCL 10B

Development of predictive techniques, with regard to cell behavior, under various operating conditions is needed to improve cell performance, increase energy density, reduce manufacturing cost, and to broaden utilization of various fuels. Such technology would be especially beneficial for the solid oxide fuel cells (SOFC) at it early demonstration stage. The development of computer models to calculate the temperature, CD, reactant distributions in the tubular and monolithic SOFCs. Results indicate that problems of nonuniform heat generation and fuel gas depletion in the tubular cell module, and of size limitions in the monolithic (MOD 0) design may be encountered during FC operation. Author

N89-12123*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

InP HOMOJUNCTION SOLAR CELL PERFORMANCE ON THE LIPS 3 FLIGHT EXPERIMENT

David J. Brinker, Russell E. Hart, Jr., Irving Weinberg, and Brian S. Smith [1988] 11 p Presented at the 20th Photovoltaic Specialists Conference, Las Vegas, Nev., 26-30 Sep. 1988; sponsored by IEEE
(NASA-TM-101390; E-4454; NAS 1.15:101390) Avail: NTIS HC A03/MF A01 CSCL 10A

Performance data for the NASA Lewis Research Center indium phosphide n+p homojunction solar cell module on the LIPS 3 Flight Experiment is presented. The objective of the experiment is to measure the performance of InP cells in the natural radiation environment of the 1100 km altitude, 60+ deg inclination orbit. Analysis of flight data indicates that the performance of the four cells throughout the first year is near expected values. No degradation in short-circuit current was seen, as was expected from radiation tolerance studies of similar cells. Details of the cell structure and flight module design are discussed. The results of the temperature dependency and radiation tolerance studies necessary for normalization and analysis of the data are included. Author

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N89-12124# Missouri Univ., Columbia. Cooperative Inst. for Applied Meteorology.

THE USE OF STATISTICAL CLIMATE-CROP MODELS FOR SIMULATING YIELD TO PROJECT THE IMPACTS OF CO2 INDUCED CLIMATE CHANGE

W. L. Decker and R. Achutuni Jul. 1988 42 p
(Contract DE-FG02-86ER-60444)
(DE88-012852; DOE/ER-60444/H1) Avail: NTIS HC A03/MF A01

This report describes the use of mathematical models to forecast the effects of increased CO2 concentration in the atmosphere. These models were created to predict crop yields under different climatic conditions. The authors have adapted them to consider climatic changes caused by the greenhouse effect. Principal climatic variables include monthly precipitation and temperature range. DOE

N89-12125# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

ORIGIN OF TROPOSPHERIC OZONE OVER CENTRAL UNITED STATES M.S. Thesis

Donna P. McNamara 1988 121 p
(AD-A196540; AFIT/CI/NR-88-25) Avail: NTIS HC A06/MF A01 CSCL 04A

Ozone (O3) is a key species in the troposphere for several reasons. It is a key ingredient of Los Angeles-type smog as a result of photochemical reactions. Tropospheric O3 also impacts the radiation budget and may cause climate change because it is a greenhouse gas with a strong absorption band centered at 9.6 micro m in the atmospheric window region (Fisherman et. al., 1979). Also, photolysis of O3 by radiation of wavelengths less than 318 nm is the primary source of hydroxyl (OH) radicals in the troposphere. Sources of tropospheric O3 have been under much debate in the past few days. O3 is known to be photochemically active in the stratosphere where it strongly absorbs ultraviolet radiation, causing the reversal in lapse rate there. GRA

N89-12126# IIT Research Inst., Bartlesville, Okla. National Inst. for Petroleum and Energy Research.

INFLUENCE OF AMBIENT TEMPERATURE, FUEL COMPOSITION, AND DUTY CYCLE ON EXHAUST EMISSIONS Final Report

D. E. Seizinger Apr. 1988 25 p
(Contract DE-FC22-83FE-60149)
(DE88-001229; NIPER-313) Avail: NTIS HC A03/MF A01

Vehicle emission tests were conducted to determine the effects of wintertime operating conditions and higher aromatic content fuels on exhaust emissions. The fleet consisted of one methanol-fueled vehicle, one diesel vehicle, and eight gasoline-fueled light-duty vehicles. Exhaust emissions determinations included unburned hydrocarbon (HC), carbon monoxide (CO), nitrogen oxides (NO sub x), benzene, formaldehyde, total aldehydes, and particulates. For the gasoline vehicles, emissions of HC, CO, and benzene at 20 F ambient were three to four times the emissions rates at 75 F. Formaldehyde and total aldehyde emissions were about 30 percent lower at 20 F ambient. The diesel vehicle had the same directional responses, but the absolute effect of ambient temperature on exhaust emissions rates was much less than that for the gasoline vehicles. The emissions of HC, CO, and benzene from the methanol vehicle at 20 F were an order of magnitude greater than the emissions rates at 75 F. Increasing the aromatic content of the fuel typically resulted in higher emissions rates at all test temperatures. The only notable exception was formaldehyde, which decreased at the lower temperatures for the gasoline vehicles. Additional tests that incorporated a 5-minute idle immediately prior to the regular driving cycle resulted in lower emissions rates over the driving cycle. The emissions rates of HC and CO on a per unit time basis during the extended idle period were about half those during the warm-up phase of tests which omitted the idle. Formaldehyde emissions, on average, were about the same for cold idle and cold transient at the 20 F ambient. DOE

N89-12127# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
BEHAVIOR OF Cd, Mn AND Pb IN FOREST-CANOPY THROUGHFALL
S. E. Lindberg 1988 24 p Presented at the SCOPE Workshop on Atmospheric Trace Metals, Oslo, Norway, 12 Sep. 1988
(Contract DE-AC05-84OR-21400)
(DE88-011020; CONF-880970-1) Avail: NTIS HC A03/MF A01

The concentrations and fluxes of Cd, Mn, and Pb were measured in wet-only precipitation events sampled above and below forest canopies at the Walker Branch Watershed in the southeastern United States over a 2-year period. The interaction of rain with the canopy resulted in a measurable increase in the concentrations of all metals in throughfall, most significantly in the concentration of Mn (which increased by a factor of 160 compared to a factor of 3 to 4 for Cd and Pb). The factors influencing the behavior of these metals in throughfall included their concentrations in the incoming rain, the amount of foliage on the trees, the rain amount, and the storm intensity. The amount of metal removed from the canopy during rain increased significantly as the residence time of the rain on the foliage surface increased. Canopy mass balance calculations using independent estimates of dry deposition suggest that the primary source of Pb in throughfall below these canopies is atmospheric deposition, while the major source of Mn is leaching from internal tree tissues. Both sources are important for Cd. DOE

N89-12128# Oak Ridge National Lab., Tenn. Health and Safety Research Div.
ENVIRONMENTAL RADIATION STANDARDS
David C. Kocher 1988 79 p Presented at the 33rd Annual Meeting of the Health Physics Society, Boston, Mass., 4 Jul. 1988
(Contract DE-AC05-84OR-21400)
(DE88-012925; CONF-880729-1) Avail: NTIS HC A05/MF A01

The document describes a presentation which reviewed current and proposed radiation standards, recommendations, and guidelines for limiting radiation exposures of the public. The document reviews the regulatory framework for limiting routine releases of radioactivity to the environment and the resulting public exposures, and contains estimates of risk corresponding to standards, recommendations and guidances. DOE

N89-12129# Desert Research Inst., Reno, Nev.
CHARACTERIZATION OF COMBUSTION AEROSOLS FOR HAZE AND CLOUD FORMATION Final Report
J. Hallett, J. G. Hudson, and C. F. Rogers Mar. 1988 32 p Prepared for Lawrence Livermore National Lab., Calif.
(Contract W-7405-eng-48)
(DE88-013806; UCRL-21059) Avail: NTIS HC A03/MF A01

Aerosols resulting from the combustion of acetylene, wood, and JP-4 aviation fuels have been characterized in both the laboratory and the larger field scales by activity as cloud condensation nuclei (CCN), the total particle or condensation nuclei (CN) count, ion chromatography (IC) on filter samples, and morphology by scanning electron microscopy. The CCN/CN ratio for a given aerosol sample is a quantitative indicator of the ability of a combustion aerosol to become involved in atmospheric removal by nucleation scavenging. On both the laboratory and the field scales, this ratio was in the range 0.2 to 1.0 for the wood combustion aerosol, 0.2 to 0.5 for the acetylene case, and only 0.01 to 0.03 for JP-4. The CCN/CN ratios are identical for both the field and laboratory studies, implying that laboratory studies of CCN activities can be justifiably extrapolated to field studies. Aging and size-classified nucleation studies are also reported. DOE

N89-12130# Pacific Northwest Labs., Richland, Wash.
PRACTICAL CONSIDERATIONS IN THE DEVELOPMENT AND APPLICATION OF REFERENCE LEVELS
J. M. Selby, W. E. Kennedy, Jr., K. L. Swinth, R. O. Gilbert, and J. K. Soldat May 1988 11 p Presented at the French Bilateral Symposium on Accident Exercises and Experiences, Tours, France, 20 Jun. 1988
(Contract DE-AC06-76RL-01830)
(DE88-014748; PNL-SA-15829; CONF-8806116-2) Avail: NTIS HC A03/MF A01

Radiological exposures to the public during an accident that releases radioactive materials to the environment occur initially through the air pathway, secondly through a water pathway, and finally, through the food chain. From these exposure pathways, reference levels of radionuclides must be applied to limit public radiation doses. Such reference levels are difficult to develop and apply, particularly if the contaminants are transuranic elements such as plutonium. The reference level must be related to a resultant theoretical dose to the public through generic calculations. However, to permit rapid decisions after an accident, the reference levels need to be related to conditions or media in the environment that can be directly measured. They must also be tied to specific countermeasures such as sheltering, evacuation, or interdiction of drinking water or food supplies. This paper discusses the practical considerations in the development and application of reference levels for transuranic in the environment and the present capability to rapidly detect and quantify their concentrations following accidental contamination events. DOE

N89-12131# Pacific Northwest Labs., Richland, Wash.
ESTIMATING CUMULATIVE ENVIRONMENTAL IMPACTS OF PROPOSED PROJECTS
Keshava S. Murthy Apr. 1988 8 p Presented at the American Nuclear Society Annual Meeting, San Diego, Calif., 12 Jun. 1988
(Contract DE-AC06-76RL-01830)
(DE88-014759; PNL-SA-15658; CONF-880601-45) Avail: NTIS HC A02/MF A01

Environmental documents typically include descriptions of direct impacts, indirect impacts, and cumulative impacts. Methods used for estimating direct impacts, such as an increase in the sulfur dioxide concentration in the air, are usually well understood and have received adequate attention in environmental documents. Indirect impacts, such as secondary developmental activities related to a new highway project, are difficult to define or predict, and tend to be ignored because of their nebulous nature and apparent irrelevance. Cumulative impacts, which are the subject of this paper, are important and should receive more careful and detailed attention than has been the case in most environmental impact documents. Attempts to define cumulative impacts have been made. The purpose of this paper is to focus on the importance of cumulative impacts for the benefit of the preparers of environmental documents and decision makers. DOE

N89-12132# Lawrence Livermore National Lab., Calif.
A TWO-DIMENSIONAL MODEL STUDY OF PAST TRENDS IN GLOBAL OZONE
Donald J. Wuebbles and Douglas E. Kinnison Aug. 1988 4 p
Presented at the International Quadrennial Ozone Symposium, Gottingen, Fed. Republic of Germany, 8 Aug. 1988
(Contract W-7405-eng-48)
(DE88-015432; UCRL-98088; CONF-8808102-3) Avail: NTIS HC A02

Emissions and atmospheric concentrations of several trace gases important to atmospheric chemistry are known to have increased substantially over recent decades. Solar flux variations and the atmospheric nuclear test series are also likely to have affected stratospheric ozone. In this study, the LLNL two-dimensional chemical-radiative-transport model of the troposphere and stratosphere has been applied to an analysis of the effects that these natural and anthropogenic influences may have had on global ozone concentrations over the last three decades. In general, model determined species distributions and the derived ozone trends agree well with published analyses of land-based and satellite-based observations. Also, the total ozone and ozone distribution trends derived from CFC and other trace gas effects have a different response with latitude than the derived trends from solar flux variations, thus providing a signature for anthropogenic effects on ozone. DOE

N89-12133# Lawrence Livermore National Lab., Calif.
A TWO DIMENSIONAL MODELING STUDY OF THE SENSITIVITY OF OZONE TO RADIATIVE FLUX UNCERTAINTIES
Keith E. Grant and Donald J. Wuebbles Aug. 1988 4 p
Presented at the International Quadrennial Ozone Symposium, Gottingen, Fed. Republic of Germany, 8 Aug. 1988
(Contract W-7405-eng-48)
(DE88-015434; UCRL-97981; CONF-8808102-1) Avail: NTIS HC A02/MF A01

Radiative processes strongly effect equilibrium trace gas concentrations both directly, through photolysis reactions, and indirectly through temperature and transport processes. We have used the LLNL 2-D chemical-radiative-transport model to investigate the net sensitivity of equilibrium ozone concentrations to several changes in radiative forcing. Doubling CO2 from 300 ppmv to 600 ppmv resulted in a temperature decrease of 5 K to 8 K in the middle stratosphere along with an 8 percent to 16 percent increase in ozone in the same region. Replacing our usual shortwave scattering algorithms with a simplified Rayleigh algorithm led to a 1 percent to 2 percent increase in ozone in the lower stratosphere. Finally, modifying normal CO2 cooling rates by corrections derived from line-by-line calculations resulted in several regions of heating and cooling. Temperature changes were observed on the order of 1 K to 1.5 K with corresponding changes of 0.5 percent to 1.5 percent in O2. Results for doubled CO2 compare favorably with those by other authors. Results for two perturbation scenarios stress the need for accurately modeling radiative processes while conferring the general validity of current models. DOE

N89-12134# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
RESEARCH IN STRATOSPHERIC OZONE. AN INITIATIVE PAPER OF THE BUNDESMINISTERIUM FUER FORSCHUNG UND TECHNOLOGIE [ERFORSCHUNG DES STRATOSPHAERISCHEN OZONS. EIN INITIATIVPAPIER DES BUNDESMINISTERS FUER FORSCHUNG UND TECHNOLOGIE]
18 Jul. 1988 42 p In GERMAN
(Rept-26/88; ETN-88-93225) Avail: NTIS HC A03/MF A01

In the framework of programs in enviromental research and technology, it is proposed to carry out in situ measurements, laboratory experiments, and numerical modeling on stratospheric ozone composition modification. Importance of ozone concentration modification, explanation of the reasons, and prevision for future developments are stressed. ESA

N89-12135# Stockholm Univ. (Sweden). Dept. of Meteorology.
A COMPARATIVE STUDY OF PRECIPITATION CHEMISTRY AT INLAND, COASTAL AND ISLAND SITES IN THE BOTHNIAN BAY AREA (BALTIC SEA)
Lennart Granat 3 May 1988 25 p
(Contracts SWED-EPB-623-2415-87; SWED-EPB-623-3104-85)
(CM-73; ISSN-0280-445X; ETN-88-93541) Avail: NTIS HC A03/MF A01

Rain chemistry measurements were made on a small island and on a lighthouse and compared with data from nine coastal and inland sites on both sides of the water. The distance from coast to coast in the area is 120 km. The concentration of SO4, NO3, and H(+) at the island site is equal and NH4 10 percent less than the value obtained by linear interpolation between coastal sites. The amount of precipitation is 30 percent less on the island, possibly representing conditions over the open water. The deposition is estimated to be 30 to 40 percent lower than the values measured at coastal sites. The concentration of seasalt components is higher at the island site but the level may depend on the sampling site. The concentration of Ca and K is a few ueq/l higher at the island site. It is suggested that estimates of wet deposition of several components of anthropogenic origin to a large water body should be made from a combination of concentration data obtained from many measurements around the water body with particular reference to coastal sites and estimated amount of precipitation over the water. A direct estimate based on deposition at coastal sites gives too high values. ESA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N89-12136 Florida State Univ., Tallahassee.
INTERANNUAL VARIABILITY OF THE CALIFORNIA CURRENT SYSTEM: A NUMERICAL MODEL Ph.D. Thesis
Alejandro Pares-Sierra 1987 146 p
Avail: Univ. Microfilms Order No. DA8805691

A reduced gravity model that incorporated the geometry of western North America has been used to study the dynamics of the California Current System (CCS). Three experiments were implemented: first the model was run using 19 years of wind stress from the Comprehensive Ocean-Atmosphere Data Set (local model); second experiment (remote model) consisted of forcing the model through its southern boundary using the results of a similar reduced gravity equatorial model; in a third experiment, both forcings were used simultaneously (local and remote model). The main objective was to analyze the low frequency variability on the CCS in terms of its contributions from remote and local forcing. Away from the coast, the basic state of the model is determined by the predominantly negative wind curl through an Sverdrup balance. The general seasonal cycle is in agreement to what was described by other authors. Through cross correlation and cross spectral analysis between the model results and observed several data, it was established that most of the interannual variability in sea-level height at the coast due to disturbanced of equatorial origin that propagate into the region in the form of coastally trapped Kelvin waves. For the annual frequency variability, on the other hand, it was found that both local, as well as remotely forced variability, contribute to the total variance. Dissert. Abstr.

N89-12137# National Oceanic and Atmospheric Administration, Washington, D. C.
REPORT OF THE EARTH RADIATION BUDGET REQUIREMENTS REVIEW

Jun. 1988 113 p Presented at a Review held in Rosslyn, Va., 30 Mar. - 3 Apr. 1987
(NOAA-TR-NESDIS-41) Avail: NTIS HC A06/MF A01

The exchange of radiative energy between the Sun, Earth and space affects the Earth's climate and is also affected by the Earth's climate. Theoretical models indicate that increases in man-made greenhouse gases, such as carbon dioxide, over decadal and longer time scales, perturbs the equilibrium between the two components of the Earth's radiation budget (ERB); i.e., (1) the heat Earth absorbs form the Sun, and (2) the heat Earth emits to space. This leads to changes in the global climate. For example, the 1983 report to the National Research Council entitled, Changing Climate (NRC, 1983), indicated that a doubling of carbon dioxide concentration was likely in the next hundred years. This would cause the Earth to emit less heat than it absorbs which would subsequently increase the globally averaged surface air temperature by between 1.5 and 4.5 C. This change would occur as a result of a small imbalance between the two ERB components of less than 1 W/sq m, globally averaged. However, these same models indicate that each component would be changed by up to 4 W/sq m, globally averaged, with regional changes varying from about 20 W/sq m in the tropics to as large as 100 W/sq m for absorbed solar radiation at the poles. These large regional changes would be due to the effects of climate feedback on the ERB components, caused primarily by increased water vapor and decreased surface snow and ice cover at the poles, both the result of the warmer climate. Thus, with a long, uninterrupted time record of stable ERB measurements, it would be possible to detect climate change associated with increases in trace gas concentrations. Author

N89-12138*# National Aeronautics and Space Administration, Washington, D.C.
RESEARCH ON THE GEOMAGNETIC FIELD
Sh. Sh. Dolginov Aug. 1988 57 p Transl. into ENGLISH from Issledovaniye Magnitnovo Polya Zemli, Izdatelstvo, Moscow (USSR), Nauka, 1978 p 135-177 Original language document was announced in IAA as A79-26332 Transl. by SCITRAN, Inc., Santa Barbara, Calif.
(Contract NASw-4307)
(NASA-TT-20344; NAS 1.77:20344) Avail: NTIS HC A04/MF A01 CSCL 08G

This review of spaceborne studies of the geomagnetic field is in three parts. The first part discusses internal fields with attention given to field models based on Cosmos-321 and Cosmos-49 data, earth surface anomalies, and secular variations of the geomagnetic field. The second part considers ionospheric and magnetospheric magnetic fields with emphasis on high-latitude magnetospheric currents, quiet-time ring currents, magnetic-storm associated ionospheric currents, and the equatorial electrojet. The third part deals with diagnostics of the interplanetary medium and the upper magnetosphere on the basis of ground-observed magnetic variations. Author

N89-12139 Illinois Univ., Urbana-Champaign.
DIFFUSE ZONES OF DEFORMATION IN OCEANIC LITHOSPHERE: THE AZORES-GIBRALTAR PLATE BOUNDARY AND THE DAVIE RIDGE-MADAGASCAR REGION Ph.D. Thesis
Nina Louise Grimison 1987 137 p
Avail: Univ. Microfilms Order No. DA8803056

Two zones of slow, internal deformation occurring in oceanic lithosphere are studied, namely, the Azores-Gibraltar plate boundary in the eastern Atlantic Ocean and the Davie Ridge-Madagascar region between the east African coast and Madagascar. Despite the slow rate of deformation, high levels of seismic activity are present in both regions. The earthquakes were analyzed by a variety of methods including formal inversion of the waveform and amplitude of teleseismic P and SH waves, first motion readings, and the identification of depth phases. Dissert. Abstr.

N89-12140*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH ALTITUDE ATMOSPHERIC MODELING
Alan E. Hedin Oct. 1988 104 p
(Contract MIPR-FY-616870485)
(NASA-TM-100707; NAS 1.15:100707; Rept-88B-0260) Avail: NTIS HC A06/MF A01 CSCL 04A

Five empirical models were compared with 13 data sets, including both atmospheric drag-based data and mass spectrometer data. The most recently published model, MSIS-86, was found to be the best model overall with an accuracy around 15 percent. The excellent overall agreement of the mass spectrometer-based MSIS models with the drag data, including both the older data from orbital decay and the newer accelerometer data, suggests that the absolute calibration of the (ensemble of) mass spectrometers and the assumed drag coefficient in the atomic oxygen regime are consistent to 5 percent. This study illustrates a number of reasons for the current accuracy limit such as calibration accuracy and unmodeled trends. Nevertheless, the largest variations in total density in the thermosphere are accounted for, to a very high degree, by existing models. The greatest potential for improvements is in areas where we still have insufficient data (like the lower thermosphere or exosphere), where there are disagreements in technique (such as the exosphere) which can be resolved, or wherever generally more accurate measurements become available. Author

N89-12141# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A SEARCH FOR WAVE INDUCED PARTICLE PRECIPITATION FROM LIGHTNING AND TRANSMITTER SOURCES M.S. Thesis
Jon E. Lundberg 1988 120 p
(AD-A196482; AFIT/CI/NR-88-10) Avail: NTIS HC A06/MF A01 CSCL 20N

Wave induced particle precipitation is introduced and examined for whistlers whose sources are within the plasmapause. The possible correlation between lightning strokes that carry positive charge to the ground and the observed Trimpi events is discussed, sudden phase and/or amplitude shifts of a received VLF signal with gradual return to predisturbed values. The thunderstorm charging mechanisms that lead to the observed charge distribution and the advection of the positively charged cirrus anvil away from the body of the thunderstorm are briefly examined. The comparative current strengths and the relative frequency of positive and negative strokes is studied for different types of thunderstorms. The magnetospheric ducting of the lightning generated whistler wave and the interaction with trapped electrons is examined. The detectable effects the precipitating electrons have on the ionosphere is introduced. Included are testing and design of the X-ray detector and balloon launch considerations. The problems encountered during the X-ray detector's balloon flights are examined. The riometer and X-ray detector data analysis methods are mentioned. The results were negative for the data that was analyzed but the limiting factors severely restricted the usable data. Possible experimental methods are mentioned. GRA

N89-12142# Harvard Univ., Cambridge, Mass.
MODEL INVESTIGATIONS OF LITHOSPHERIC PROPAGATION Final Report, 1 Apr. 1979 - 31 Mar. 1988
Tai T. Wu, Ronold P. King, and Michael F. Brown May 1988 290 p
(Contract N00014-79-C-0419)
(AD-A196552) Avail: NTIS HC A13/MF A01 CSCL 20N

Research on the Model Investigations of Lithospheric Propagation, has been conducted at Harvard University for nine years under the sponsorship of the Office of Naval Research. This Final Report summarizes the scientific accomplishments achieved under ONR Contract N00014-79-C-0419 during the period April 1, 1979 through March 31, 1988. The program of research has provided geophysicists with new, quantitatively accurate, and practically useful knowledge for the exploration of the oceanic crust by way of its electrical properties. The results are described in 25 technical papers. GRA

N89-12143# Science Applications International Corp., San Diego, Calif.

ATTENUATION AND DETECTION CAPABILITY OF REGIONAL PHASES RECORDED AT NORESS Semiannual Report No. 3, 1 Mar. - 31 Aug. 1987

Thomas J. Sereno, Jr. and Steven R. Bratt 25 Mar. 1988 152 p
(Contract F19628-86-C-0051)
(AD-A196568; SAIC-88/1598; AFGL-TR-88-0095) Avail: NTIS HC A08/MF A01 CSCL 17J

The attenuation and detectability of regional Pn and Lg phases recorded at the NORESS array in Norway are estimated. We determine the frequency-dependent attenuation by inverting Pn and Lg single-channel spectra recorded at NORESS from 186 events at ranges between 200 to 1400 km with magnitudes between 1.1 and 4.8. The Pn spectra are inverted between 1 to 15 Hz and the Lg spectra between 1-7 Hz for both seismic moment and apparent attenuation. To resolve parameter trade-offs, we require that the separate Pn and Lg attenuation models produce an internally consistent set of source parameters. We find that regional Pn spectra are accurately described by 1/r to the 1.3 power geometric spreading and Q(f) = 325f to the 0.48 power. Lg spectra computed for a group velocity window of 3.6 to 3.0 km/s are consistent with cylindrical spreading and Q(f) = 560f to the 0.26 power. We determine the sensitivity of our estimates to the window length used in Fourier analysis, geometric spreading and source assumptions, and the inversion bandwidth. The final result is a simple parameterization of the source and range dependence of regional Pn and Lg spectra. Since signal detection is based on time domain amplitudes measured on filtered beams, a parameterization of single-channel spectra is not sufficient to determine detection capability, we determine a relationship between the spectral amplitudes used in the inversion and the time domain amplitudes used in signal detection. GRA

N89-12144# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

MEASURING ATMOSPHERIC FREE RADICALS USING CHEMICAL AMPLIFICATION M.S. Thesis

Bernard T. Ghim May 1988 144 p
(AD-A196704; AFIT/CI/NR-88-159) Avail: NTIS HC A07/MF A01 CSCL 07B

Atmospheric free radicals play an important role in early all atmospheric cycles. The focus of this research was to continue characterizing the PEroxy Radical measurement by Chemical Amplification (PERCA) method first investigated by Cantrell (1983, 1984), then Buhr (1986). Experiments proved the original model of the PERCA method developed by Cantrell was too simple. New instrument modifications have insured optimum performance for peroxy radical measurement in clean, dry environments. The instrument is currently calibrated under laboratory conditions by observing the decay of HO2 radicals in a formaldehyde photolysis system. The reported chain lengths of 600 are in reasonable agreement with previously reported methods. GRA

N89-12145# Lawrence Livermore National Lab., Calif.

SEISMIC HAZARD ANALYSIS OF WESTERN VENEZUELA METHODOLOGY AND DATA COLLECTION PROCESS

Jean Savy Jun. 1988 48 p
(Contract W-7405-eng-48)
(DE88-014697; UCID-21454) Avail: NTIS HC A08/MF A01

This project, initiated by INTEVEP, develops a seismic hazard characterization for the region of the Lake Maracaibo basin in Western Venezuela (WV) with an emphasis at the sites of dikes built on the eastern side of the lake. One task of the project was to assess the seismicity of this region and to describe it in a form which can be used as input to a seismic hazard analysis. The seismic parameters were seismo-tectonic zonation, distribution of earthquake magnitudes, and the largest earthquake, i.e., upper magnitude cutoff. Because it is difficult, or perhaps impossible, to precisely quantify such seismic parameters using only the sparse historical record, expert judgment is crucial. Thus two panels of experts were assembled to supplement the lack of opinions in the possible models of zonation, seismicity, (S-panel) and ground motion attenuation (G-panel). In addition to the ground motion models described in the ground motion questionnaire handed to the G-panel experts, we performed some analysis, at LLNL, to develop a new breed of models where the parameter of interest is now the number of cycles of a given fraction of a peak ground acceleration as a function of magnitude and distance from the source of an earthquake, rather than the peak ground acceleration (PGA) as a function of magnitude and distance. DOE

N89-12146# Pacific Northwest Labs., Richland, Wash.

COMPARISON OF SKY LUMINANCE MAPS WITH INSTANTANEOUS ALL-SKY IMAGES

B. A. LeBaron, J. J. Michalsky (State Univ. of New York, Albany.), and N. R. Larsen Mar. 1988 11 p Presented at Solar '88: American Solar Energy Society Annual Meeting and 13th National Passive Solar Conference, Cambridge, Mass., 18 Jun. 198
(Contract DE-AC06-76RL-01830)
(DE88-014752; PNL-SA-15722; CONF-880615-6) Avail: NTIS HC A03/MF A01

Daylighting designers and modelers require more information than can be provided by measures of the the total illuminance arriving at a surface. A knowledge of the luminance spatial distribution is critical to predicting interior penetration and reflection. A qualitative comparison of contour maps, generated from a series of point measurements around the sky dome, and concurrent instantaneous all-sky photographs is made for clear, overcast, and partly cloudy conditions. It is shown that a discrete set of all-sky measurements, requiring 3 minutes to complete, are adequate to qualitatively capture the structure in the luminance distribution, even under rapidly changing cloud conditions. The models examined, performed reasonably well for the clear and overcast sky when conditions were symmetric and stable, but were unsatisfactory for the anisotropy exhibited under partly cloudy skys. The comparisons suggest that scanning instruments can quantify the essential features of a luminance distribution for conditions of high anisotropy. DOE

N89-12147# Spectral Sciences, Inc., Burlington, Mass.

HAIRM-87: A HIGH ALTITUDE INFRARED RADIANCE MODEL Technical Report, Sep. - Dec. 1987

R. L. Sundberg, D. C. Robertson, R. D. Sharma, and A. J. Ratkowski 14 Jan. 1988 77 p
(Contract F19628-87-C-0130)
(AD-A197637; SSI-TR-132; AFGL-TR-88-0014; SR-1) Avail: NTIS HC A05/MF A01 CSCL 04A

HAIRM, the AFGL/Visidyne High Altitude Infrared Radiance Model, calculates atmospheric radiance over the spectral region from 250 to 6000/cm (1.67 to 40.0 micrometers) and over altitudes from 60 to 250 km. It calculates NLTE (non-local thermodynamic equilibrium) radiation from five atmospheric molecules, CO2, H2O, NO, O3 and CO. The older version, which evolved over many years of analyses and modeling of AFGL field data, consists of eight separate programs or modules which are run individually. This version of the code, HAIRM-87, has linked these programs together under a single MAIN routine and added an interactive input module that prompts the user for the various code inputs. Additionally some proprietary integrating subroutines have been replaced, so that the code can be released to the DoD community (Upon request to AFGL/LSP). HAIRM-87 is identical in model content to the earlier version. GRA

N89-12148# United Technologies Research Center, East Hartford, Conn.

THEORETICAL STUDY OF THE RADIATIVE AND KINETIC PROPERTIES OF SELECTED METAL OXIDES AND AIR MOLECULES Technical Report, 2 May 1985 - 2 Mar. 1988

H. H. Michels 2 Mar. 1988 102 p
(Contract DNA001-85-C-0120)
(AD-A197647; UTRC-927149; DNA-TR-88-12) Avail: NTIS HC A06/MF A01 CSCL 04A

The release of certain chemical species into the upper atmosphere results in luminous clouds that display the resonance electronic-vibration-rotation spectra of the chemically reacting species. Such spectra are seen in rocket releases of chemicals for upper atmospheric studies, upon re-entry into the atmosphere of artificial satellites and missiles, and as a result of energy deposition in the atmosphere caused by nuclear weapons effects. Of particular interest in this connection is the observed spectra of certain metallic oxides. GRA

N89-12149# SRI International Corp., Menlo Park, Calif.
HIGH-LATITUDE F-REGION IRREGULARITIES: A REVIEW AND SYNTHESIS Technical Report, 1 Jan. 1986 - 1 Jul. 1987
Roland T. Tsunoda 15 Feb. 1988 144 p
(Contract DNA001-86-C-0002)
(AD-A197698; DNA-TR-88-44) Avail: NTIS HC A07/MF A01
CSCL 04A

The most intense, F region irregularities in the high latitude ionosphere appear to be produced by convective plasma processes, and in particular, the fluid E x B (gradient drift) interchange instability. Irregularities are produced by convectively mixing plasma across a mean plasma density gradient. The transport of higher-density plasma into regions of lower density plasma (and vice versa) leads to the development of an irregularity spectrum that extends in scale from about 10 km down to the ion gyroradius. Because irregularities with this range of scales are not independent from larger scale plasma structures that are produced by other means, the characteristics and processes of greater than 10 km plasma structure are reviewed and related to those of smaller scale irregularities. For the large scale plasma processes, the model includes (1) the formation of 1000 km scale patches in the polar cap from solar-produced plasma that is transported poleward from lower latitudes; (2) the reconfiguration of patches as they convect into the auroral region and become the latitudinally confined but longitudinally extended, plasma-density enhancements near the equatorward auroral boundary; and (3) the production of localized enhancements and depletions along the poleward auroral boundary by soft-particle precipitation and large but localized electric fields. In the model, the most intense, smaller-scale irregularities fields. GRA

N89-12150# Bonn Univ. (West Germany). Hohen Mathematisch-Naturwissenschaflichen Fakultaet.
INVESTIGATIONS ON LARGE AND SMALL SCALE DYNAMIC PROCESSES IN THE MESOSPHERE AND UPPER STRATOSPHERE BY MEANS OF WIND AND DENSITY MEASUREMENTS ABOVE NORTHERN SCANDINAVIA IN THE FRAMEWORK OF THE MAP/WINE PROJECT Ph.D. Thesis [UNTERSUCHUNGEN GROSS- UND KLEINSKALIGER DYNAMISCHER PROZESSE IN DER MESOSPHAERE UND OBEREN STRATOSPHAERE ANHAND VON WIND- UND DICHTEMESSUNGEN UEBER NORDSKANDINAVIEN IM RAHMEN DES MAP/WINE PROJEKTS]
Werner Meyer May 1988 95 p In GERMAN
(Contract DFG-ZA-83/3-1)
(BONN-IR-88-19; ISSN-0172-8741; ETN-88-93196) Avail: NTIS HC A05/MF A01

Observations of winds and density in the mesosphere and upper stratosphere were carried out by continous methods to gain information on the state of the middle atmosphere. Investigations concern hemispheric dynamic processes, stratospheric reheating, large scale dynamic coupling of stratosphere and mesosphere, small scale displacements of heavy waves to turbulent scale, and measurements of trace gases in the middle atmosphere. ESA

N89-12151 GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.
POLYCHROMATOR FOR MEASUREMENT OF ATMOSPHERIC CARBON DIOXIDE AND WATER VAPOR BY RAMAN-LIDAR
Edgar Voss 1987 14 p In GERMAN; ENGLISH summary Presented at MIOP '87 Congress, Wiesban, Fed. Republic of Germany, 19-21 May 1987
(GKSS-87/E/66; ISSN-0344-9629; ETN-88-93198) Avail: GKSS-Forschungszentrum Geesthacht G.m.b.H., Max-Planck-Strasse, D-2054 Geesthacht, Fed. Republic of Germany

The optical arrangement and the properties of a polychromator designed for a three-channel Raman lidar are described. For main dispersion an R2 echelle grating with 316 grooves/mm is operated in 17th order. A plane holographic grating with a groove density of 2400 grooves/mm is used in first order for cross dispersion to separate overlapping orders. The collimator and the camera mirror are off-axis parabolas of 479 mm focal length. The whole equipment is optimized for 320.7 nm, the wavelength of the CO2 channel. In this channel the transmission is measured to be 4.2 percent for unpolarized light. The linear dispersion is 5.2 mm/nm. With 0.58 mm-diameter holes for entrance and exit slit the bandpass is 0.094 nm. In this case the residual stray light of the (Mie and Rayleigh scattered) primary line is 0.0000008; the perturbation of the CO2 signal by the neighboring O2 band amounts to less than 3 percent. ESA

N89-12152# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
CONCENTRATION MEASUREMENTS OF AITKEN NUCLEI IN THE STRATOSPHERE Final Report [MESSUNG DER KONZENTRATION VON AITKENKERNEN IN DER STRATOSPHAERE]
1987 41 p In GERMAN Sponsored by BMFT, Bonn, Fed. Republic of Germany
(ETN-88-93223) Avail: NTIS HC A03/MF A01

Atmosphere ion and trace gas distribution is investigated and effects on aerosol formation are studied with Aitken nuclei concentration measurements in the stratosphere. Two Aitken nuclei counters were developed and launched by balloon for data collection. Aerosol formation mechanics is derived and models are proposed. ESA

N89-12153 Royal Netherlands Meteorological Inst., De Bilt. Physical Meteorology Dept.
VERTICAL PROFILES OF THE STRUCTURE PARAMETER OF REFRACTIVE INDEX AND THE STRUCTURE PARAMETER OF TEMPERATURE IN THE EARTH'S ATMOSPHERE
J. W. M. Cuijpers (Amsterdam Univ., Netherlands) Dec. 1987 70 p
(KNMI-WR-87-13; ISSN-0169-1651; ETN-88-93577) Copyright Avail: Royal Netherlands Meteorological Inst., P.O. Box 201, 3730 AE De Bilt, Wilhelminalaan 10, Netherlands

Vertical profiles of the structure parameter of temperature in the stable, nocturnal boundary layer are obtained with models. Theoretical profiles are compared with observed profiles obtained at a meteorological mast. The influence of turbulence in the Earth's atmosphere on stellar image degradation is assessed. For individual titles, see N89-12154 through N89-12155.

N89-12154 Royal Netherlands Meteorological Inst., De Bilt.
VERTICAL PROFILES OF THE STRUCTURE PARAMETER OF TEMPERATURE IN THE STABLE, NOCTURNAL BOUNDARY LAYER, PART 1
J. W. M. Cuijpers (Amsterdam Univ., Netherlands) *In its* Vertical Profiles of the Structure Parameter of Refractive Index and the Structure Parameter of Temperature in the Earth's Atmosphere Dec. 1987 p 5-38 (For primary document see N89-12153 03-46)
Copyright Avail: Royal Netherlands Meteorological Inst., P.O. Box 201, 3730 AE De Bilt, Wilhelminalaan 10, Netherlands

Vertical profiles of the structure parameter of temperature (C sub T)sq in the stable, nocturnal boundary layer are obtained with the models described by Nieuwstadt (1984, 1985), Sorbjan (1986) and Duynkerke and Driedonks (1987). These theoretical profiles are compared with observed profiles obtained at the meteorological mast at Cabauw, The Netherlands. From the observations it is found that (C sub T)sq is large in the surface layer and small at the top of the boundary layer. Observations during nights with moderate geostrophic winds or during the first few hours of nights with a high geostrophic wind show a continuous decrease of (C sub T)sq from surface layer to the top of the boundary layer.

Observations done later at nights with a high geostrophic wind show the development of a maximum of (C sub T)sq at three quarters of the boundary layer. From the comparison with the models it is concluded that the observed profiles are best described by the model of Duynkerke and Driedonks. ESA

N89-12155 Royal Netherlands Meteorological Inst., De Bilt.
VERTICAL PROFILES OF THE STRUCTURE PARAMETER OF REFRACTIVE INDEX IN THE EARTH'S ATMOSPHERE, PART 2
J. W. M. Cuijpers (Amsterdam Univ., Netherlands) *In its* Vertical Profiles of the Structure Parameter of Refractive Index and the Structure Parameter of Temperature in the Earth's Atmosphere Dec. 1987 p 39-62 (For primary document see N89-12153 03-46)
Copyright Avail: Royal Netherlands Meteorological Inst., P.O. Box 201, 3730 AE De Bilt, Wilhelminalaan 10, Netherlands

The influence of turbulence in the Earth's atmosphere on stellar image degradation is discussed. By measuring temperature fluctuations or stellar scintillations the vertical profiles of the structure parameter of refractive index (C sub N)sq can be obtained. Observations show that (C sub N)sq varies from position to position and from time to time. In the first 100 to 200 m above the ground (C sub N)sq is large. Above the boundary layer (C sub N)sq decreases sharply. In the troposphere turbulence is layered; (C sub N)sq generally decreases with height. However, an increase is seen in situations with winds from or towards mountains or near temperature inversions. In the stratosphere (C sub N)sq is small. It is concluded that the lower troposphere is most responsible for phase fluctuations causing image movement and image blurring, whereas the tropopause region seems to be more responsible for amplitude fluctuations causing scintillation. ESA

N89-12156# Consiglio Nazionale delle Ricerche, Frascati (Italy). Istituto di Fisica dello Spazio Interplanetario.
LOW-ENERGY IONOSPHEIC O(+) STREAMS IN THE PLASMA SHEET
S. Orsini, M. Candidi, M. Stokholm, and H. Balsiger Oct. 1987 34 p Original contains color illustrations
(IFSI-87-15; ETN-88-93462) Avail: NTIS HC A03/MF A01

A statistical analysis of the ion streams in the earth's magnetotail was done, trying to demonstrate that the lobe streams enter the plasma sheet and that properties of the stream plasma are modified after this entry in such a way as to make it a part of the plasma sheet itself. Observations of ion streams in the lobes and in the plasma sheet boundary layer show that the stream ions are accelerated on average at the boundary crossing. The drift patterns are such that they agree with those implied by the Rostoker and Bostrom mode of the tail electric field; everywhere it is possible to infer a slope in the scatter of the data. ESA

N89-11933# Lancaster Univ. (England). Dept. of Environmental Science.
THE HIGH-LATITUDE IONOSPHERE: GEOPHYSICAL BASIS
J. K. Hargreaves *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 27 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

N89-11938# Lancaster Univ. (England). Dept. of Environmental Science.
THE HIGH-LATITUDE IONOSPHERE: DYNAMICAL ASPECTS, AND MODELS
J. K. Hargreaves *In* AGARD, Media Effects on Electronic Systems in the High Latitude Region Sep. 1988 22 p (For primary document see N89-11931 03-32)
Copyright Avail: NTIS HC A10/MF A01

N89-12097*# Ohio State Univ., Columbus.
PRESENTATIONS BY PARTICIPANTS (EDITED AND CONDENSED)
R. R. B. vonFrese *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 13-21 (For primary document see N89-12095 03-42)
(Grants NAGw-736; NSF DPP-83-13071)
Avail: NTIS HC A04/MF A01 CSCL 08G

N89-12098# Newcastle Univ. (England).
WORKING GROUP REPORTS SUBMITTED BY GROUP CHAIRMEN FOLLOWING WORKSHOP
Frank J. Lewes *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 41 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08D

N89-12099# National Geophysical Data Center, Boulder, Colo.
WORKING GROUP ON STUDIES OF THE LITHOSPHERE: RECOMMENDATIONS
David Hastings *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 42 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08D

N89-12102# Geological Survey, Dover, Del.
A STUDY OF ACCURACY ENHANCEMENT IN SATELLITE MAGNETIC MODELING
Z. Wang and J. C. Cain *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 52-58 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08G

N89-12103# Colorado Univ., Boulder.
SATELLITE MEASUREMENTS REQUIRED FOR DEEP-EARTH GEOPHYSICS
Edward R. Benton *In* Naval Ocean Research and Development Activity, Geomagnetic Autonomous Shuttle-Launched Probe Workshop Jun. 1987 p 59-60 (For primary document see N89-12095 03-42)
Avail: NTIS HC A04/MF A01 CSCL 08G

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N89-12157# Lawrence Livermore National Lab., Calif.
THE ROLE OF ATMOSPHERIC CHEMISTRY IN CLIMATE CHANGE
Donald J. Wuebbles, Keith E. Grant, Peter S. Connell, and Joyce E. Penner Jun. 1988 15 p Presented at the 81st Annual Meeting of Air Pollution Control Association, Dallas, Tex., 1 Jun. 1988
(Contract W-7405-eng-48)
(DE88-012439; UCRL-97811; CONF-880679-8) Avail: NTIS HC A03/MF A01

Surface emissions and concentrations of globally important trace gases are increasing. Climate models indicate significant temperature increases could occur in the next century due to increasing CO2 concentrations. However, the combined direct radiative effects from other trace gases could be as large as those estimated for CO2. Many of these gases also have indirect effects on climate through their chemical interactions with other radiatively important atmospheric constituents. For example, within the troposphere, emissions of CH4, CO, and NO(x) may increase concentrations of hydroxyl (OH), which, while not radiatively important, has an important impact on tropospheric chemistry and on the concentrations of long-lived gases reaching the stratosphere. In the stratosphere, dissociation of CH4, N2O, and the CFCs can lead to changes in the ozone distribution. Oxidation of increasing CH4 concentrations would increase stratospheric concentrations of radiatively important water vapor. Climate change can, on the other hand, alter tropospheric H2O concentrations, further affecting chemistry impacts on climate. In this paper, we examine the importance of chemical processes and other interactions in determining climatic change and future policy options. DOE

N89-12158*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LAWS (LASER ATMOSPHERIC WIND SOUNDER) EARTH OBSERVING SYSTEM
1988 68 p Original document contains color illustrations
(NASA-TM-101204; NAS 1.15:101204) Avail: NTIS HC A04/MF A01 CSCL 04B

Wind profiles can be measured from space using current technology. These wind profiles are essential for answering many of the interdisciplinary scientific questions to be addressed by EOS, the Earth Observing System. This report provides guidance for the development of a spaceborne wind sounder, the Laser Atmospheric Wind Sounder (LAWS), discussing the current state of the technology and reviewing the scientific rationale for the instrument. Whether obtained globally from the EOS polar platform or in the tropics and subtropics from the Space Station, wind profiles from space will provide essential information for advancing the skill of numerical weather prediction, furthering knowledge of large-scale atmospheric circulation and climate dynamics, and improving understanding of the global biogeochemical and hydrologic cycles. The LAWS Instrument Panel recommends that it be given high priority for new instrument development because of the pressing scientific need and the availability of the necessary technology. LAWS is to measure wind profiles with an accuracy of a few meters per second and to sample at intervals of 100 km horizontally for layers km thick. Author

N89-12159# Army Missile Command, Redstone Arsenal, Ala.
VERTICAL WINDSHEAR BELOW 1 km FOR BERLIN, GERMANY AND CENTREVILLE, ALABAMA Annual Report, Jun. 1987 - May 1988
Larry J. Levitt May 1988 59 p
(AD-A196351; AD-E951145; AMSMI/TR-RD-RE-88-3) Avail: NTIS HC A04/MF A01 CSCL 04B

Windspeed differences, wind direction differences, and vertical windshear within the layer from surface to 1 km were compared for two locations, Berlin, Germany and Centreville, Alabama. Seasonal variation of the cumulative distributive function of vertical windshear were plotted. Maximum windshear generally occurred during the winter with the exception that above 99 percent probability, the windshear in the spring usually exceeded the winter windshear. Vertical windshear was found to increase with increasing surface windspeed up until the 90 to 95 percent probability range. Wind direction changes associated with extreme windshears were found to be site-specific. For the layer surface to 600m, vertical windshear of greater than 10m/s was accompanied by a wind direction change of greater than 60 degrees six times as often at Centreville as compared with Berlin. Author (GRA)

N89-12160# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
KAZAN USSR LIMITED SURFACE OBSERVATIONS CLIMATIC SUMMARY (LISOCS). PARTS A-F Data Summary, Nov. 1977 - Oct. 1987
Jun. 1988 256 p
(AD-A196644; USAFETAC/DS-88/027-Pt-A-F) Avail: NTIS HC A12/MF A01 CSCL 04B

A statistical data summary of surface weather observation climatology for Kazan (USSR) is given. This summary is similar to the Revised Uniform Summary of Surface Weather Observations (RUSSWO), but is based on data collected from limited-duty weather observing stations, i.e., those that take weather observations less than 24 hours a day, 7 days a week. The summary is in five parts: (1) Weather Conditions and Atmospheric Phenomena; (2) Surface Winds; (3) Ceiling and Visibility; (4) Psychrometric Summaries; and (5) Pressure Summaries. See USAFETAC/TN-83-001 (ADA132186), An Aid For Using The Revised Uniform Summary of Surface Weather Observations (RUSSWO), for complete descriptions of contents and instructions for use. GRA

N89-12161# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A CLIMATOLOGY OF AIR PARCEL TRAJECTORIES INTO MT. MITCHELL, NORTH CAROLINA M.S. Thesis
Steven S. Seabaugh 1988 132 p
(AD-A196678; AFIT/CI/NR-88-114) Avail: NTIS HC A07/MF A01 CSCL 04B

Within this thesis, a climatology of air parcel trajectories into Mt. Mitchell has been developed. Further, a high ozone episode during 1986 at Mt. Mitchell has been examined to try to determine the cause of the high ozone values and whether or not ozone transport had any bearing on the case. The climatology was developed in four parts. First, a determination of whether corrections made to the data, due to the omission of those trajectories which encountered high vertical wind shear, affected the results. Second, a climatology of trajectories was built. Third, a climatological summary of those trajectories associated with high ozone was developed. And finally, a set of conditional probability maps for ozone was presented. The case study was undertaken to examine the meteorological conditions surrounding a high ozone event which occurred on 4 to 8 July 1986. An effort was made to try to determine the cause of the high ozone levels which were measured at Mt. Mitchell at that time. One particular item of interest was whether or not ozone transport had occurred. The results indicated no evidence of direct ozone transport, but rather that local photochemical generation of ozone and/or ozone precursor chemical transport were the prime causes of the locally measured ozone increase. GRA

N89-12162# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
LIMITED SURFACE OBSERVATIONS CLIMATIC SUMMARY (LISOCS), MURMANSK, USSR, PARTS A-F Data Summary Report, Sep. 1977 - Aug. 1987
Jun. 1988 266 p
(AD-A196764; USAFETAC/DS-88/026) Avail: NTIS HC A12/MF A01 CSCL 04B

A statistical data summary of surface weather observation climatology: Murmansk USSR. This summary is similar to the Revised Uniform Summary of Surface Weather Observations (RUSSWO), but is based on data collected from limited-duty weather observing stations; i.e., those that take weather observations less than 24 hours a day, 7 days a week. The summary is in five parts: PART 1, Weather Conditions and Atmospheric Phenomena; PART 2, Surface Winds; PART 3, Ceiling and Visibility; PART 4, Psychrometric Summaries; and PART 5, Pressure Summaries. See USAFETAC/TN-83-001 (AD132186), An Aid For Using The Revised Uniform Summary of Surface Weather Observations (RUSSWO), for complete descriptions of contents and instructions for use. GRA

N89-12163# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
LOW-LEVEL OUTFLOW POTENTIAL OF NON-TORNADIC THUNDERSTORMS INFERRED FROM SINGLE-DOPPLER RADAR Ph.D. Thesis
Gary L. Sickler 1988 154 p
(AD-A196875; AFIT/CI/NR-88-37) Avail: NTIS HC A08/MF A01 CSCL 17I

This research examines non-tornadic storms to improve the predictability of low-level storm outflow and to determine whether or not early signatures exist in the structures of the single-Doppler reflectivity and velocity fields that signal the development of a severe downdraft in a non-tornadic storm. By examining the magnitude and changes of radial divergence, flux, shear, and other storm parameters, inferences are made to conclude storm severity and the potential for strong low-level outflow. Storm parameters are calculated through a series of steps. After initial screening, single-Doppler data are dealiased prior to performing a running average of the velocity field. Then, a search is made along each radial for intervals over which radial divergence is indicated; this is followed by predetermined shear and flux threshold tests. These intervals are used to calculate the storm parameters. Corresponding storm reflectivity fields are observed to identify fluctuations in growth and decay. Qualitative and quantitative inferences are drawn concerning the structure of the velocity and reflectivity fields and their relationship with low-level storm outflow. GRA

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N89-12164 College of William and Mary, Williamsburg, Va.
LOW-ENERGY BEDLOAD TRANSPORT BY COMBINED WAVE AND CURRENT FLOW ON A SOUTHERN MID-ATLANTIC BIGHT SHOREFACE Ph.D. Thesis
Malcolm Omand Green 1987 177 p
Avail: Univ. Microfilms Order No. DA8803969

The control of the mean flow, wind-wave energy and wind-wave asymmetry on low-energy bedload transport magnitude, direction, and divergence on a wave-dominated shoreface was investigated. The objective was to develop a mechanistic basis for postulated fairweather replenishment of the beach sediment prism by sediments derived from offshore. Fairweather currents were measured at 17.5 and 22 m depth. Periods of competent flow were identified using a combined-flow boundary-layer model. Madsen and Grant's (1976) combined-flow bedload-transport model was used to calculate sediment fluxes after modification of the expression for instantaneous transport rate to include a threshold criterion; this was necessary since sediment is not in motion over the whole wave period in low-energy conditions. Bedloae-flux divergence associated with each observed event was simulated using a one-dimensional numerical model. Observations and model calculations were consistent with the concept of fairweather nourishment of the beach sediment prism by sediment transported from offshore, however the mean flow may play a more important role than previously recognized. Dissert. Abstr.

N89-12165# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
FIELD REPORT: OCEANOGRAPHIC CONDITIONS IN THE ICELAND-FAEROE FRONTAL ZONE, APRIL 1988. PHASE 1 Final Report, 21 - 27 Apr. 1988
Janice D. Boyd and George Heburn May 1988 71 p
(AD-A197680; NORDA-TN-384) Avail: NTIS HC A04/MF A01 CSCL 08C

Between 21-27 April 1988, the Tactical Oceanography Project of the Naval Ocean Research and Development Activity (NORDA) provided near real time processing and analysis of environmental data acquired during the first phase of the NATO exercise RESOLUTE SUPPORT/PROUD RUNNER. This report assembles together the analysis results produced in the field to give an overview of the oceanographic conditions during the exercise. An assessment of the acoustic conditions encountered will be the subject of a later report. GRA

51 LIFE SCIENCES (GENERAL)

N89-12166*# Lockheed Engineering and Sciences Co., Washington, D.C.
USSR SPACE LIFE SCIENCES DIGEST, ISSUE 19
Lydia Razran Hooke, ed., P. Lynn Donaldson, ed., Ronald Teeter, ed., Victoria Garshnek, ed., and Joseph Rowe, ed. (Library of Congress, Washington, D. C.) Washington NASA Oct. 1988 121 p
(Contract NASw-4292)
(NASA-CR-3922(22); NAS 1.26:3922(22)) Avail: NTIS HC A06/MF A01 CSCL 06C

This is the 19th issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 47 papers published in Russian language periodicals or presented at conferences and of 5 new Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. Reports on two conferences, one on adaptation to high altitudes, and one on space and ecology are presented. A book review of a recent work on high altitude physiology is also included. The abstracts in this issue have been identified as relevant to 33 areas of space biology and medicine. These areas are: adaptation, biological rhythms, biospherics, body fluids, botany, cardiovascular and respiratory systems, cytology, developmental biology, endocrinology, enzymology, biology, group dynamics, habitability and environmental effects, hematology, human performance, immunology, life support systems, man-machine systems, mathematical modeling, metabolism, microbiology, musculoskeletal system, neurophysiology, nutrition, operational medicine, perception, personnel selection, psychology, radiobiology, and space biology and medicine. Author

N89-12167*# Rockefeller Univ., New York.
VESTIBULAR REFLEXES OF OTOLITH ORIGIN Final Technical Report, 1 Apr. 1979 - 31 Dec. 1987
Victor J. Wilson 27 Oct. 1988 14 p
(Grant NsG-2380)
(NASA-CR-183309; NAS 1.26:183309) Avail: NTIS HC A03/MF A01 CSCL 06C

The vestibular system and its role in the maintenance of posture and in motion sickness is investigated using cats as experimental subjects. The assumption is that better understanding of the physiology of vestibular pathways is not only of intrinsic value, but will help to explain and eventually alleviate the disturbances caused by vestibular malfunction, or by exposure to an unusual environment such as space. The first project deals with the influence on the spinal cord of stimulation of the vestibular labyrinth, particularly the otoliths. A second was concerned with the properties and neural basis of the tonic neck reflex. These two projects are related, because vestibulospinal and tonic neck reflexes interact in the maintenance of normal posture. The third project began with an interest in mechanisms of motion sickness, and eventually shifted to a study of central control of respiratory muscles involved in vomiting. Author

N89-12168# Montana State Univ., Bozeman. Dept. of Chemistry.
MECHANISM OF CONVERSION OF LIGHT INTO CHEMICAL ENERGY IN BACTERIORHODOPSIN: IDENTIFICATION OF CHARGE MOVEMENTS AND COUPLING TO ACTIVE SITE CONFORMATIONAL CHANGES Annual Report, Apr. 1987 - Jun. 1988
Edward A. Dratz 30 Jun. 1988 9 p
(Contract N00014-87-K-0278; Proj. RR0-4108)
(AD-A196624) Avail: NTIS HC A02/MF A01 CSCL 06A

Bacteriorhodopsin is the best understood transmembrane ion pump. Bacteriorhodopsin creates ca. 100 mV transmembrane potential by pumping protons across its membrane when illuminated by visible light. Visible light isomerizes a small (ca. 300 Dalton) chromophore called retinal which drives protein conformational changes that accomplish the pumping. Pumping occurs in a series of steps, and the intermediate forms can be trapped for study at sufficiently low temperatures. New methods of solid state NMR have recently provided striking new information on the detailed structure of the retinal active site in bacteriorhodopsin. However, the light induced changes that produce transmembrane proton pumping have not been studied. Experiments underway are designed to reveal the light induced conformational changes at the active site, the light induced charge movements, and the coupling of the charge motion to the active site conformational changes in bacteriorhodopsin using new solid state NMR methods. GRA

N89-12169# Catholic Univ. of America, Washington, D.C. Dept. of Physics.
TRANSIENT INTERACTION OF ELECTROMAGNETIC PULSES IN DIELECTRICS AND MICROWAVE BIOPHYSICS Final Report, 1 Jun. 1985 - 30 May 1988
Theodore C. Guo and Wendy W. Guo 12 May 1988 70 p
(Contract N00014-85-K-0475)
(AD-A196838; Rept-5-88-WRAIR/ONR) Avail: NTIS HC A04/MF A01 CSCL 06G

Due to recent progress in developing equipments that can generate short microwave and millimeter wave pulses, there has been an increasing proliferation of microwave pulse transmitters, some with short pulse width (0.1 microsecond) and extremely high intensity (100 to 1000 megawatts). Microwave pulse transmitters are used extensively by the military for communication and remote control; using microwave pulses as directive energy weaponary and as means of transporting energy has also been contemplated. Electromagnetic pulses (EMP) are also emitted in nuclear blasts and from EMP simulators. All this production of microwave pulses affects the operation of military personnel in non-combat environment as well as in battle fields. Therefore minimizing microwave damage is central to successful operations of all military units. Understanding basic interactions between microwave pulses and dielectric materials will contribute greatly to the protection of human subjects from microwave damage and to the development of preventive measure. GRA

N89-12170# Colorado Univ., Boulder. Dept. of Electrical and Computer Engineering
EFFECTS OF ULTRASOUND PULSING ON NEURAL EXCITABILITY Annual Report, 1 Apr. 1987 - 30 Jun. 1988
H. Wachtel and R. Mihran 30 Jun. 1988 7 p
(Contract N00014-87-E-0313; Proj. RR0-4108)
(AD-A197492) Avail: NTIS HC A02/MF A01 CSCL 06G

We have used brief bursts of relatively low intensity ultrasound (US) to alter the excitability of myelinated fibers within the frog sciatic nerve. The magnitude and direction of these changes are critically dependent on the timing of the burst relative to the electrical stimulus and are different for various fiber types and frog species. These effects cannot be emulated using equivalently timed electrical pre-stimuli and cannot be attributed to electrode artifacts. Since temperature rises of less than 0.01 C accompany effective US bursts and the levels are far below those causing cavitation, the effect is thought to be of a direct micromechanical nature. A selective activation or repression of slow conductance channels would, at this juncture, appear to be the most plausible explanation for these effects. GRA

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N89-12171# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.
MOTION CUES IN FLIGHT SIMULATION AND SIMULATOR INDUCED SICKNESS
Jun. 1988 196 p In ENGLISH and FRENCH Symposium held in Brussels, Belgium, 29 Sep. - 1 Oct. 1987
(AGARD-CP-433; ISBN-92-835-0466-6) Copyright Avail: NTIS HC A09/MF A01

These proceedings include seventeen papers, ensuing discussions of the papers, and a Round Table Discussion from the Symposium sponsored by the AGARD Aerospace Medical Panel held in Brussels, Belgium. The frequency of reports of undesirable effects associated with simulator training has increased as simulator usage has increased to offset the higher costs and risks of conducting training in the complex modern aircraft. Review of current and anticipated future trends in simulator design features suggests that additional problems will arise if research on the etiology of simulator-induced motion sickness and other unwanted simulator effects is insufficient to counteract problems before they arise. The objective of this symposium was to examine simulator-induced effects, their operational implications, and their etiology in order to develop ideas for reducing undesired effects. For individual titles, see N89-12172 through N89-12188.

N89-12172# Essex Corp., Orlando, Fla.
ETIOLOGICAL SIGNIFICANCE OF EQUIPMENT FEATURES AND PILOT HISTORY IN SIMULATOR SICKNESS
R. S. Kennedy, K. S. Berbaum, G. O. Allgood, N. E. Lane, M. G. Lilienthal (Naval Training Systems Center, Orlando, Fla.), and D. R. Baltzley *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 22 p (For primary document see N89-12171 03-52)
Copyright Avail: NTIS HC A09/MF A01

The U.S. Navy has conducted a survey in 10 flight trainers where motion experience questionnaires and performance tests were administered to pilots before and after 1200 separate exposures. From these measures on pilots, several findings emerged: (1) specific histories of motion sickness were predictive of simulator sickness symptomatology; (2) postural equilibrium was degraded after hops in some simulators; (2) self-reports of motion sickness symptomatology revealed three major symptom clusters; gastrointestinal, visual, and vestibular; (3) certain pilot experiences in simulators and aircraft were related to severity of symptoms experienced; (4) simulator sickness incidences varied from 10 to 60 percent; (4) substantial perceptual adaptation occurs over a series of hops; (6) in two moving-base flight trainers motion sickness incidence appeared to be related to the amount of acceleration (energy) experienced in frequency ranges around 0.2 Hz. The findings are discussed in the context of sensory conflict theory and recommendations are made for simulator design criteria. Suggestions are made as to how to relate simulator and equipment configuration to the separate symptom clusters as an aid to the diagnosis of specific problems within particular simulators. It is believed that this holds promise in diagnosing simulator equipment problems (e.g, alignment, inertial motion profile, cue asynchrony) since different symptom clusters may be related to different equipment features. Author

N89-12173# National Aerospace Lab., Amsterdam (Netherlands).
TECHNOLOGY INVOLVED IN THE SIMULATION OF MOTION CUES: THE CURRENT TREND
H. A. Mooij *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 15 p (For primary document see N89-12171 03-52)
Copyright Avail: NTIS HC A09/MF A01

The subject of motion cue generation is a topic that requires serious attention from all involved in the design, development and manufacture of flight simulators. The enhanced realism in the depiction of terrain, sky, and other aircraft available in current visual systems has been associated with an increasing number of instances of simulator sickness. This form of sickness is the constellation of symptoms which may be experienced by pilots as a result of flying a simulator. As one of the introductory papers of the AGARD Aerospace Medical Symposium on Motion cues in flight simulation and simulator induced sickness this paper presents observations concerning the current trend in visual and motion systems. After an introduction of basic cuing methodology in flight simulation, the overview concentrates on developments in image generation, image display, platform motion cue generation and motion hardware mechanisms. The paper concludes with some observations concerning the importance of maintenance and calibration of flight simulator installations. Author

N89-12174# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
AETIOLOGICAL FACTORS IN SIMULATOR SICKNESS
A. J. Benson *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 8 p (For primary document see N89-12171 03-52)
Copyright Avail: NTIS HC A09/MF A01

The clinical features of simulator sickness are similar to the malaise induced by other motion stimuli. The essential etiology of the condition is considered to be the same as in other types of motion sickness, namely, the mismatch between the motion information provided by the body's sense organs and the brain's internal model of expected motion cues. The mismatch can be between concomitant inputs provided by the angular and linear acceleration transducers of the vestibular apparatus, or between visual and vestibular inputs. More significantly, in a fixed base simulator it is the absence of expected inertial cues when the ambient visual system is stimulated by the external world, visual display that engenders neural mismatch. Even when the simulator has a motion base, quantitive and temporal disparities between visual and inertial cues commonly occur and can contribute, along with visual distortions and other anomalies, to the induction of the motion sickness syndrome. Author

N89-12175# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France). Centre d'Essais en Vol.

HORIZONTAL STUDY OF THE INCIDENCE OF SIMULATOR INDUCED SICKNESS AMONG FRENCH AIR FORCE PILOTS [ETUDE HORIZONTALE DE L'INCIDENCE DU MAL DES SIMULATEURS DANS LES FORCES AERIENNES FRANCAISES]

A. Leger, P. Sandor, and R. P. Delahaye (Service de Sante pour l'Armee de l'Air, Paris, France) *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 7 p In FRENCH; ENGLISH summary (For primary document see N89-12171 03-52)
Copyright Avail: NTIS HC A09/MF A01

Reports of simulator sickness obtained from pilots in the Air Force of France are summarized. Of 164 pilots responding, 153 responses were judged suitable for general descriptive analysis, and 132 were retained for detailed analysis. In contrast to other studies in which on-site investigators evaluated effects induced by specific simulators, questionnaires were used to obtain information on the past simulator experience of pilots (and motion sickness in general) from different units of the French Air Force. Thus, the results are based on questionnaires answered anonymously relating to past experience in different simulators over a number of years. Sixty-seven percent of those responding had experienced simulator-induced sickness to some degree, but the majority of effects elicited were moderate and decreased rapidly after several sessions. Aftereffects were absent in 51 percent, insignificant in 34.8 percent, moderate in 9.8 percent, and severe in 3.8 percent of the responding subjects. In contrast with an earlier study, statistically significant relationship between simulator sickness and motion sickness in general (indicated by scores from a motion sickness questionnaire) was not found. Author

N89-12176# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

SIMULATOR INDUCED SICKNESS AMONG HERCULES AIRCREW

L. E. Magee, L. Kantor, and D. M. C. Sweeney *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 8 p (For primary document see N89-12171 03-52)
Copyright Avail: NTIS HC A09/MF A01

The purposes of this study were to investigate the incidence, severity and time-course of simulator sickness among pilots and flight engineers training on a C-130H (Hercules) flight simulator, and to assess the influence of flight experience on susceptibility. Evidence of simulator sickness was collected by questionnaire, tests of balance, and observation. The questionnaires were completed at the conclusion of a four-hour training session and 20 hours later. The balance tests were performed immediately prior to and immediately following the training session. Overt signs of pallor, sweating, drowsiness and visual nystagmus were also recorded at these times. Thirty-five of the 42 aircrew (i.e., 83 percent) tested reported characteristic symptoms of simulator sickness. The most prevalent were eyestrain, mental and physical fatigue, and after-sensations of motion. Some effects persisted following simulator training for many hours although most were not severe. Few had delayed onset. Although eleven subjects (26 percent) reported loss of balance at the end of the training session, performance on the balance tests improved; this suggests a practice effect which masks ataxia. With the exception of occasional nystagmus, no overt signs of simulator sickness were evident. The relationships between aircraft experience, both general and type-specific, and diagnostic scores based on symptoms were examined. There was no evidence to indicate that experience influenced susceptibility to simulator sickness. Author

N89-12177# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

SIMULATOR SICKNESS IN THE ROYAL AIR FORCE: A SURVEY

J. W. Chappelow *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 11 p (For primary document see N89-12171 03-52)
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A questionnaire survey was undertaken of pilots with experience of two air combat simulators. Two hundred and seventy one respondents completed questionnaires, some up to two years retrospectively and others immediately after a simulator session. There were, thus, four separate studies. The questionnaires sought information on the incidence of disequilibrium and other symptoms experienced in the simulator and after leaving it. The proportion of those suffering at least one symptom in the simulator varied between 50 percent and more than 90 percent across studies (53.5 percent overall). However, not all the symptoms reported were unequivocally ascribable to disequilibrium. The proportion of each sample reporting delayed symptoms was between 10 percent and 50 percent (13 percent overall). The effect on the respondents' motivation to use the simulator was negligible. Author

N89-12178# Army Aeromedical Research Lab., Fort Rucker, Ala.

SIMULATOR SICKNESS IN US ARMY AND NAVY FIXED- AND ROTARY-WING FLIGHT SIMULATORS

Daniel W. Gower, Jr., Michael G. Lilienthal, Robert S. Kennedy, and Jennifer E. Fowlkes (Essex Corp., Orlando, Fla.) *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 20 p (For primary document see N89-12171 03-52)
Copyright Avail: NTIS HC A09/MF A01

As technology has been developed to provide improved visual and motion systems in operational flight trainers and weapons tactics trainers, there have been increasing reports of the occurrence of simulator sickness. Simulator sickness here refers to one or more symptoms which can occur while in a simulator, immediately after exposure, or at some later time. Flight instructors have complained these symptoms interfere with simulator usage. More critical is the potential for in-flight problems due to prolonged physiological effects. As a result, flight activities after simulator flight have been limited in some commands. The U.S. Army Aeromedical Research Laboratory at Fort Rucker, Alabama, and the Naval Training Systems Center at Orlando, Florida, conducted field surveys to document the extent of the simulator sickness problems at operational fixed and rotary-wing simulator sites. Data are pooled from 10 different Navy flight simulators and the Army's AH-64 flight simulator. The total number of surveys is about 1500, with the number of subjects in each simulator type ranging from 18 to 280. The simulator sickness incidence rates and the relative frequency of specific symptoms are presented and correlational factors such as flight experience, simulator experience, and flight mode also are presented. Difficulties in assessing the duration of simulator sickness effects are noted, and attempts made to present the symptom duration for the Army's AH-64 combat mission simulator (CMS). Unique to this CMS is its use of the helmet display unit (HDU) in conjunction with the other visuals in the simulator. Author

N89-12179*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE USE OF VESTIBULAR MODELS FOR DESIGN AND EVALUATION OF FLIGHT SIMULATOR MOTION

Steven R. Bussolari, Laurence R. Young (Massachusetts Inst. of Tech., Cambridge.), and Alfred T. Lee *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 11 p (For primary document see N89-12171 03-52)
(Grant NAG2-12)
Copyright Avail: NTIS HC A09/MF A01

Quantitative models for the dynamics of the human vestibular system are applied to the design and evaluation of flight simulator platform motion. An optimal simulator motion control algorithm is generated to minimize the vector difference between perceived spatial orientation estimated in flight and in simulation. The motion controller has been implemented on the Vertical Motion Simulator at NASA Ames Research Center and evaluated experimentally through measurement of pilot performance and subjective rating during VTOL aircraft simulation. In general, pilot performance in a longitudinal tracking task (formation flight) did not appear to be sensitive to variations in platform motion condition as long as motion was present. However, pilot assessment of motion fidelity by means of a rating scale designed for this purpose, were sensitive to motion controller design. Platform motion generated with the optimal motion controller was found to be generally equivalent to that generated by conventional linear crossfeed washout. The vestibular models are used to evaluate the motion fidelity of transport category aircraft (Boeing 727) simulation in a pilot performance and simulator acceptability study at the Man-Vehicle Systems Research Facility at NASA Ames Research Center. Eighteen airline pilots, currently flying B-727, were given a series of flight scenarios in the simulator under various conditions of simulator motion. The scenarios were chosen to reflect the flight maneuvers that these pilots might expect to be given during a routine pilot proficiency check. Pilot performance and subjective rating of simulator fidelity was relatively insensitive to the motion condition, despite large differences in the amplitude of motion provided. This lack of sensitivity may be explained by means of the vestibular models, which predict little difference in the modeled motion sensations of the pilots when different motion conditions are imposed. Author

N89-12180# German Army Hospital, Ulm (West Germany). Abt. Neurologie and Psychiatrie.
MOTION CUES IN EVERY DAY LIFE
J. Kriebel, A. Kornhuber, and M. Lang (Ulm Univ., West Germany) *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 8 p (For primary document see N89-12171 03-52)
Copyright Avail: NTIS HC A09/MF A01

Motion cues are perceived via different sensory modalities. Convergence of teleceptive and proprioceptive sensory information is a prerequisite of task-related senseful motor reaction. Research with event-related brain potentials (ERP) delivers important functional and topographical information of these complex interactions. From ERP data the function of the frontomesial supplementary motor area (SMA) could be analyzed. Their important role in timing sequential tasks and connecting the sensory and motor system is demonstrated. Sensory dysfunctions might irritate the onset and sequence of task related motor reactions. Vestibular evoked cerebral potentials are chosen to demonstrate the restrictions of the interpretion of the ERP results. From steady state evoked and transient evoked potentials further knowledge can be expected. Author

N89-12181# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.
MANIFESTATION OF VISUAL/VESTIBULAR DISRUPTION IN SIMULATORS: SEVERITY AND EMPIRICAL MEASUREMENT OF SYMPTOMATOLOGY
John G. Casali and Lawrence H. Frank (Pacific Missile Test Center, Point Mugu, Calif.) *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 18 p (For primary document see N89-12171 03-52)
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Reported incidence rated of vehicular simulator induced sickness in operators is highly variable both within and between devices. Recent literature reviews show that documented incidence rates range from 0 to nearly 90 percent in flight devices and even higher in some driving devices. However, the severity of the simulator sickness problem is not adequately gauged by a simple count of those operators experiencing one or more physiologic symptoms. Instead, a battery of metrics is useful in identifying and properly assessing an induced state of simulator sickness. This is of particular importance with the recent thrust in empirical research toward determination of the effects of simulator design parameters, such as control loop delays, on operator sickness and performance. This paper reviews the symptomatology experienced by operators of flight and driving simulators. Drawing upon this review, dependent measures are recommended for use in simulator-sickness research, including self-report forms, specific physiologic indices, postural equilibrium tests, performance tests, and susceptibility prediction instruments. A tabular documentation of published research studies concerning simulator sickness is also provided. Author

N89-12182# Pacific Missile Test Center, Point Mugu, Calif.
MODELLING OPERATOR CONTROL PERFORMANCE AND WELL-BEING AS A FUNCTION OF SIMULATOR VISUAL AND MOTION SYSTEM TRANSPORT DELAYS
Lawrence H. Frank and John G. Casali (Virginia Polytechnic Inst. and State Univ., Blacksburg.) *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 7 p (For primary document see N89-12171 03-52)
Copyright Avail: NTIS HC A09/MF A01

The role of visual-motion coupling delays and cueing order on operator performance and uneasiness was assessed in driving simulators by means of a response surface methodology central-composite design. The most salient finding of the study was that visual delay appears to be more disruptive to an individual's control performance and well-being than is motion delay. Empirical multiple regression models were derived to predict 10 reliable measures of simulator operator driving performance and comfort. Principal components analysis on these 10 models decomposed the dependent measures into two significant models which were labeled vestibular disruption and degraded performance. Examination of the empirical models revealed that, for asynchronous delay conditions, better performance and well-being were achieved when the visual system led the motion system. A secondary analysis of the role of subject gender and perceptual style on susceptibility to simulator sickness revealed that neither of these independent variables was a significant source of variance. Author

N89-12183# Centre de Medecine Aerospatiale, Brussels (Belgium).
AN INVESTIGATION OF SIMULATOR SICKNESS AND AN ELECTRONYSTAGMOGRAPHIC STUDY [ENQUETE SUR LE MAL DES SIMULATEURS DE VOL COUPLEE A UNE ETUDE NYSTAGMORGRAPHIQUE]
G. DeHeyn, P. DeGraff, and P. Vandenbosch *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 5 p In FRENCH; ENGLISH summary (For primary document see N89-12171 03-52)
Copyright Avail: NTIS HC A09/MF A01

Simulator sickness, which is related to travel sickenss, is a product of high technology, safety requirements and budgetary limitations. This new pathology affects experienced pilots and is the result of conflicting sensations, experienced in an unfamiliar environment. We conducted a survey of a Belgian Air Force fighter squadron in order to evaluate the frequency of simulator sickness and the symptoms experienced. Ten percent of the pilots questioned regularly experienced simulator sickness and twenty-five percent felt it occasionally in varying degrees. We also attempted to objectify the problems of vertigo and disorientation by means of an electronystagmographic study of 12 pilots during their training on a flight simulator. We were surprised by the poor ocular response during the simulated flight. Nystagmic movements appeared rarely and then only fleetingly, mainly at the end of a turn. They were all low amplitude. We were not able to establish a correlation between the objective vestibular responses and the subjective feelings of simulator sickness. Author

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N89-12184*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HEAD-MOUNTED SPATIAL INSTRUMENTS: SYNTHETIC REALITY OR IMPOSSIBLE DREAM

Stephen R. Ellis, Arthur Grunwald, and Mordekhai Velger *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 8 p (For primary document see N89-12171 03-52)

Copyright Avail: NTIS HC A09/MF A01

A spatial instrument is defined as a display device which has been either geometrically or symbolically enhanced to better enable a user to accomplish a particular task. Research conducted over the past several years on 3-D spatial instruments has shown that perspective displays, even when viewed from the correct viewpoint, are subject to systematic viewer biases. These biases interfere with correct spatial judgements of the presented pictorial information. It is also found that deliberate, appropriate geometric distortion of the perspective projection of an image can improve user performance. These two findings raise intriguing questions concerning the design of head-mounted spatial instruments. The design of such instruments may not only require the introduction of compensatory distortions to remove the neutrally occurring biases but also may significantly benefit from the introduction of artificial distortions which enhance performance. These image manipulations, however, can cause a loss of visual-vestibular coordination and induce motion sickness. Additionally, adaptation to these manipulations is apt to be impaired by computational delays in the image display. Consequently, the design of head-mounted spatial instruments will require an understanding of the tolerable limits of visual-vestibular discord. Author

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N89-12185# York Univ. (Ontario). Human Performance Lab.

INFLUENCE OF VECTION AXIS AND BODY POSTURE ON VISUALLY-INDUCED SELF-ROTATION AND TILT

I. P. Howard, B. Cheung, and J. Landolt (Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario) *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 8 p (For primary document see N89-12171 03-52)

Copyright Avail: NTIS HC A09/MF A01

Yaw vection is induced by a scene rotating about spinal axis (z axis), pitch vection by a scene rotating about an axis in the mid-frontal plane (y axis) and roll vection by a scene rotating about an axis parallel to the line of sight (x axis). Each of these axes can be vertical or horizontal, making six conditions in all, of which only four have been studied previously. We studied vection and illusory body tilt under all six conditions, with a full rotating field, reduced somesthetic cues and in a situation in which body rotation could occur. Yaw vection around a vertical axis was strongest. Forward pitch vection was stronger than backward pitch vection. Contrary to previous reports, for most subjects backward illusory tilt was much stronger than forward illusory tilt. Two subjects experienced 360 deg body rotation in the horizontal-pitch condition. The direction of pitch axis asymmetry was found to be consistent and not related to the asymmetry of vertical optokinetic nystagmus. Author

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N89-12186# York Univ. (Ontario). Human Performance Lab.

VECTION AND THE SPATIAL DISPOSITION OF COMPETING MOVING DISPLAYS

I. P. Howard, M. Ohmi, W. Simpson, and J. P. Landolt (Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario) *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 8 p (For primary document see N89-12171 03-52)

(Contract DCIEM-97711-4-7936/8SE84-00110)

Copyright Avail: NTIS HC A09/MF A01

In Experiment 1 we investigated the relative effectiveness of two superimposed displays in generating circular vection as a function of: (1) the separation in depth between them, (2) their perceived relative ditances, and (3) which display was in the plane of focus. Circular vection was found to be governed by the display that was perceived to be more distant, even when it was actually nearer. Vection was not affected by whether the near or far display was in the plane of focus, nor by which display was fixated or pursued by the eyes. In Experiment 2 we asked whether the generally held belief that vection is induced most effectively by the peripheral stimuli is due to an artifactual effect of perceived distance. The experiment assessed the separate contributions of foreground-background and central-peripheral placement of competing displays. It was found that both factors contribute in an interactive way to the experience of vection. In Experiment 3 we investigated how linear forward vection induced by a looming visual display is affected by the near-far relationships of competing displays. Author

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N89-12187# University Hospital, Leuven (Belgium). Dept. of Otoneurology and Equilibriometry.

CUES FOR TRAINING VERTIGO, PROVIDING SUGGESTIONS FOR THE MANAGEMENT OF SIMULATOR SICKNESS

Marcel E. Norre *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 4 p (For primary document see N89-12171 03-52)

Copyright Avail: NTIS HC A09/MF A01

Clinical experience with excercise treatment for vertigo has confirmed the extreme adaptibility of the balance system. Vestibular Habituation Training (VHT) for provoked (positioning) vertigo provides some interesting cues in the scope of the theme of this meeting, related to simulator sickness. The disabling sensation, called motion sickness, means only a distrubance similar to vertigo. In both, the sensory observation of the environment by the three sensors results in a sensory mismatch. In vertigo it is one of the sensors that works in a wrong way and in motion sickness it is an unusual presentation of the environment structure that causes the mismatch. Provoked vertigo as well as motion sickness is linked to actual working of the system. In both situations the system has to work up changing relationships: in the provoked vertigo the changing situation has no contradiction in se related to a normal working schedule of the system, whereas it has in motion sickness. In both cases it must be possible to re-organize the effect of the changed sensory input by central adaptation. Clinical experience confirmed it; repeated exposure to the mismatch is the very stimulus and has a positive effect in provoked vertigo. Persons with motion sickness can be habituated in the same way as we observe it for our patients with provoked vertigo: i.e., progressively by exposure and specifically, related to the stimulus pattern of the exposure. Author

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N89-12188*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PREADAPTATION TO THE STIMULUS REARRANGEMENT OF WEIGHTLESSNESS: PRELIMINARY STUDIES AND CONCEPTS FOR TRAINER DESIGNS

D. E. Parker and M. F. Reschke *In* AGARD, Motion Cues in Flight Simulation and Simulator Induced Sickness Jun. 1988 9 p Prepared in cooperation with Miami Univ., Oxford, Ohio (For primary document see N89-12171 03-52)

Copyright Avail: NTIS HC A09/MF A01

An effort to develop preflight adaptation training (PAT) apparatus and procedures to adapt astronauts to the stimulus rearrangement of weightless spaceflight is being pursued. Based on the otolith tilt-translation reinterpretation model of sensory adaptation to weightlessness, two prototype preflight adaptation trainers (PAT) have been developed. These trainers couple pitch movement of the subject with translation of the visual surround. Subjects were exposed to this stimulus rearrangement for periods of 30 m. The hypothesis is that exposure to the rearrangement would attenuate vertical eye movements was supported by two experiments using the Miami University Seesaw (MUS) PAT prototype. The Dynamic Environment Simulator (DES) prototype failed to support this hypothesis; this result is attributed to a pecularity of the DES apparatus. A final experiment demonstrated that changes in vertical eye movements were not a consequence of fixation on an external target during exposure to a control condition. Together these experiments support the view that preflight adaptation training can alter eye mbvements in a manner consistent with adaptation to weightlessness. Following these initial studies, concepts for development of operational preflight trainers were proposed. The trainers are intended to: demonstrate the stimulus rearrangement of weightlessness; allow astronauts to train in altered sensory environment; modify sensory motor reflexes; and reduce/eliminate space motion sickness symptoms. Author

N89-12189# Oak Ridge National Lab., Tenn. Health and Safety Research Div.
PUBLIC HEALTH RISK FROM ELF (ELECTROMAGNETIC FIELDS) EXPOSURE: CAN IT BE ASSESSED
T. E. Aldrich and C. E. Easterly 1988 4 p Presented at the Meeting of the International Agency for Research on Cancer, Lyon, France, 2 May 1988
(Contract DE-AC05-84OR-21400)
(DE88-015277; CONF-8805176-1) Avail: NTIS HC A02/MF A01

Extremely low frequency electromagnetic fields (ELF) are a ubiquitous environmental agent. There are persistent indications that these fields have biologic activity, and consequently, there may be a deleterious component to their action. Epidemiologic researchers of ELF face several methodological obstacles, and quantitative risk assessment is in a quandary. Simply stated there is a need for more data, especially with regard to exposure assessment. DOE

N89-12190# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
BIOLOGICAL EFFECTS OF VERY LOW DOSES OF IONIZING RADIATION
V. S. Evseev 1987 6 p
(DE88-703372; JINR-E-19-87-465) Avail: NTIS (US Sales Only) HC A02/MF A01

The paper deals with a qualitative microdosimetric analysis of a new radiobiological phenomenon (physiological reaction of the cell as a whole to very low doses of ionizing radiations). The analysis is aimed at identifying the type of the primary interaction of radiation with the cell and finding its place in the cell. DOE

N89-12191# Army Research Inst. of Environmental Medicine, Natick, Mass.
HEAT-RELATED ILLNESSES
Barry E. Yarbrough and Roger W. Hubbard Apr. 1988 86 p
(AD-A197730; USARIEM-M-52/88) Avail: NTIS HC A05/MF A01 CSCL 06E

This chapter in the 2nd edition of the Management of Wilderness and Environmental Emergencies provides background material in the following areas: Physics of heat transfer, physiology of human body temperature regulation, the CNS interface between thermosensors and thermoregulatory effectors, skin blood flow and vasodilation, and acclimatization. The heat illnesses coverage includes information on predisposing factors, thermometry, and fever versus hyperthermia. The review of heat illnesses includes heat cramps, heat edema, heat syncope, heat exhaustion and heat stroke. Treatment coverage includes the differential diagnosis, classical versus exertional forms of heatstroke, the systematic and cellular approach to pathophysiology which includes an organ by organ analysis. The specifies of treatment provides insight to electrolyte abnormalities, acid-base abnormalities and the ABC's of therapy including cooling, modalities, adjunctive measures and prevention. GRA

N89-12192*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPUTER PROGRAM FOR PROCESSING IMPEDANCE CARDIOGRAPHIC DATA: IMPROVING ACCURACY THROUGH USER-INTERACTIVE SOFTWARE
Patricia S. Cowings, Karen Naifeh, and Chet Thrasher Oct. 1988 58 p Prepared in cooperation with California Univ., San Francisco
(NASA-TM-101020; A-88260; NAS 1.15:101020) Avail: NTIS HC A04/MF A01 CSCL 06P

This report contains the source code and documentation for a computer program used to process impedance cardiography data. The cardiodynamic measures derived from impedance cardiography are ventricular stroke column, cardiac output, cardiac index and Heather index. The program digitizes data collected from the Minnesota Impedance Cardiograph, Electrocardiography (ECG), and respiratory cycles and then stores these data on hard disk. It computes the cardiodynamic functions using interactive graphics and stores the means and standard deviations of each 15-sec data epoch on floppy disk. This software was designed on a Digital PRO380 microcomputer and used version 2.0 of P/OS, with (minimally) a 4-channel 16-bit analog/digital (A/D) converter. Applications software is written in FORTRAN 77, and uses Digital's Pro-Tool Kit Real Time Interface Library, CORE Graphic Library, and laboratory routines. Source code can be readily modified to accommodate alternative detection, A/D conversion and interactive graphics. The object code utilizing overlays and multitasking has a maximum of 50 Kbytes. Author

N89-12193# Atomic Weapons Research Establishment, Aldermaston (England).
ULTRASONIC RESUSPENSION OF COLLECTED DUST ON FILTER PAPERS FOR PARTICLE SIZE ANALYSIS
J. N. Parsons May 1988 31 p
(AWE-O-10/88; BR106846; ISBN-0-85-518182-6; ETN-88-93563) Copyright Avail: Her Majesty's Stationary Office, 49 High Holborn, London W.C. 1, United Kingdom, 4 pounds

A method which resuspends and aerodynamically analysizes aerosols, collected on personal air samples (PASs), from which data can be obtained to predict respiratory tract deposition following occupational exposure is described. Three uranium oxide dusts were studied and the effect of PAS collection and subsequent regeneration were measured. Disruption of the size distributions is observed but predictions of deposition in the various respiratory tract regions are sufficiently accurate to assist in assessment of internal radiation dose. Correction factors which further improve the accuracy of the predictions are suggested. ESA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N89-12194# Paris II Univ., Orsay (France). Recherche En Informatique.
IMPROVING THE TOOLS OF SYMBOLIC LEARNING Final Report, 1985 - 1987
Yves Kodratoff 1 Sep. 1987 36 p
(Contract DAJA45-85-C-0014; DA Proj. 1L1-61102-BH-57)
(AD-A192254; LRI-321; ARDG(E)-R/D-4624-CC-01) Avail: NTIS HC A03/MF A01 CSCL 23B

Concepts relating to symbolic machine learning (ML) are discussed in this report. These concepts include knowledge representation, descriptive notations, and methods of generalization ML techniques have been applied to scene analysis through implementation of a system that learns features in order to recognize multi-font characters. Highlights of this research are discussed. In its first part, this paper presents some consequences of the choice of the definition of Generalization. It discusses the definitions based on deduction, versus those based on substitution. In its second part, it shows how symbolic computations are also able to take into account, at least partly, the noise most real-life data show. It discusses symbolic approaches to noise handling in Scene Analysis, rule learning, strategy learning and, finally, of the idea of polymorphic Version Space. GRA

N89-12195# Katholieke Universiteit, Nijmegen (Netherlands). Psychologisch Lab.
ROLE OF CONCENTRATION IN SIMPLE MENTAL TASKS: AN EXPERIMENTAL TEST OF SOME MODELS
G. J. P. vanBreukelen and R. W. T. L. Jansen 1987 42 p
(PB88-208962; Rept-87-MA-08) Avail: NTIS HC A03/MF A01
CSCL 05I

To explain response time (RT) fluctuations in continuous performance on routine mental tasks such as concentration and mental speed tests, Pieters and Van der Ven (1982) proposed the Poisson-Erlang model. The model assumes that RT fluctuations on such tasks are mainly due to distractions. Van der Ven, Smit, and Jensen (1987) developed a modification of the Poisson-Erlang model, the Inhibition model, which can accomodate monotone trend in RT-series. The present experiment served to test both models as well as the distraction hypothesis in general. Subjects were given the Bourdon concentration test in an experimental format. Experimental factors were massed vs spaced work and a bonus for improvement of speed without loss of precision. The results support the distraction hypothesis and globally the models as well, although the models need some modification. Implications for RT studies as well as mental testing are discussed, and some suggestions are given for extending the models. GRA

N89-12196# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN EMPIRICAL INVESTIGATION OF THE IMPACT OF THE ANCHOR AND ADJUSTMENT HEURISTIC ON THE AUDIT JUDGMENT PROCESS Ph.D. Thesis
Anthony H. Presutti, Jr. 1988 93 p
(AD-A196481; AFIT/CI/NR-88-162) Avail: NTIS HC A05/MF A01 CSCL 12C

This research investigated the operation of the anchor and adjustment heuristic in the environment of the continuing audit engagement. Specifically, the impact of information concerning the previous year's compliance test results was measured over several reported error rates from the current year's compliance test results. The experimental instrument was applied to two classes of participants, audit practitioners from both public accounting and a government audit service. Each participant was required to supply an estimate of the total population error rate using the information given and the risk assessment methodology. The results of this empirical investigation determined that the addition of prior year information appears to moderate the impact of the anchor and adjustment heuristic by reducing the participants' confidence that the statistical sample error rate represents an acceptable population error rate. GRA

N89-12197# Educational Testing Service, Princeton, N. J.
THE INFORMATION MATRIX IN LATENT-VARIABLE MODELS
Robert J. Mislevy and Kathleen M. Sheehan Apr. 1988 38 p
(Contract N00014-85-K-0683; Proj. RR0-4204)
(AD-A196609; RR-88-24-ONR) Avail: NTIS HC A03/MF A01
CSCL 05H

The information matrix for the parameters in a latent-variable model is bounded from above by the information that would obtain if the values of the latent variables could also be observed. The difference is the missing information. This paper discusses the structure of the information matrix, and characterizes the degree to which missing information can be recovered by exploiting collateral variables for respondents. The results are illustrated with data from the Armed Services Vocational Aptitude Battery. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N89-12198# Army Research Inst. of Environmental Medicine, Natick, Mass.
PHYSIOLOGICAL RESPONSES TO A PROTOTYPE HYBRID AIR-LIQUID MICROCLIMATE COOLING SYSTEM DURING EXERCISE IN THE HEAT
Bruce S. Cadarette, Andrew J. Young, Barry S. DeCristofano, Karen L. Speckman, and Michael N. Sawka Apr. 1988 32 p
(AD-A194759; USARIEM-T-12/88) Avail: NTIS HC A03/MF A01 CSCL 06P

The effectiveness of a prototype air-liquid hybrid microclimate cooling system was compared to previously developed air- and liquid-cooled systems to assess heat stress reduction during physical exercise. This hybrid system could be used by combat vehicle crewmen needing both types of cooling for mounted and dismounted activities. All subjects completed the 120 minutes of exercise with all four microclimate cooling systems. The data demonstrate that the prototype air-liquid hybrid microclimate cooling system allowed the same endurance time (ET) as the air (A) and liquid (L) systems. However, the small but significantly greater thermal strain shown with the hybrid-liquid configuration relative to the air (A) system indicates a potential need for an alteration in the amount of cooling provided for the HL configuration, as it had lowest calculated cooling capacity of all the systems. GRA

N89-12199*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STEREO DEPTH DISTORTIONS IN TELEOPERATION
Daniel B. Diner and Marika vonSydow 15 May 1988 57 p
(Contract NAS7-918)
(NASA-CR-180242; JPL-Pub-87-1-Rev-1; NAS 1.26:180242)
Avail: NTIS HC A04/MF A01 CSCL 05H

In teleoperation, a typical application of stereo vision is to view a work space located short distances (1 to 3m) in front of the cameras. The work presented here treats converged camera placement and studies the effects of intercamera distance, camera-to-object viewing distance, and focal length of the camera lenses on both stereo depth resolution and stereo depth distortion. While viewing the fronto-parallel plane 1.4 m in front of the cameras, depth errors are measured on the order of 2cm. A geometric analysis was made of the distortion of the fronto-parallel plane of divergence for stereo TV viewing. The results of the analysis were then verified experimentally. The objective was to determine the optimal camera configuration which gave high stereo depth resolution while minimizing stereo depth distortion. It is found that for converged cameras at a fixed camera-to-object viewing distance, larger intercamera distances allow higher depth resolutions, but cause greater depth distortions. Thus with larger intercamera distances, operators will make greater depth errors (because of the greater distortions), but will be more certain that they are not errors (because of the higher resolution). Author

N89-12200 New South Wales Univ., Kensington (Australia).
ADAPTATION IN THE HUMAN ACCOMMODATION SYSTEM Ph.D. Thesis
Richard K. T. Tan Jan. 1988 3 p
Avail: Issuing Activity

The dark focus and adaptation in the ocular accommodation system is examined. The aspects governing dark focus positioning was found to be important. In the adaptation studies, one of the issues examined was whether the dark focus plays a important part in the accommodation system. This issue was resolved by studying dark focus and the close-loop accommodation system concurrently in their habitual and adapted states. The dark focus was found to be influenced by the level of premeasurement accommodation. The effect is dependent on the magnitude and direction of accommodation response from the dark focus and the duration of sustained accommodation. With reference to the dark focus level, positive accommodation resulted in a bigger shift than negative accommodation. When the temporal stability of the dark focus was studied, it was found that dark focus position was determined by the accommodative history of the individual. The unadapted accommodation system showed that the dark focus is located at the pivot of the accommodative response stimulus curve. During near work, the gain of the accommodative response curve decreases as the height of the response increases. Author

N89-12201# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE EFFECTS OF BIODYNAMIC STRESS ON WORKLOAD IN HUMAN OPERATORS Final Report, Dec. 1986 - Aug. 1987
William B. Albery Jan. 1988 239 p
(AD-A196720; AAMRL-TR-88-004) Avail: NTIS HC A11/MF A01 CSCL 06J

The objective of this research was to assess the effect of high intensity noise stress and of sustained acceleration on human operator workload and performance. Workload was measured via three different methodologies. Subjective workload was measured with the Subjective Workload Assessment Technique (SWAT); performance-based measures were derived from single and dual psychomotor task performance; and physiological parameters included heart rate, blood pressure, total eye blinks duration, forearm electromyogram and evoked response EEG, especially the latency and amplitude of the P300 peak. The dual task workload consisted of a primary tracking task and a secondary task of monitoring a modified Radar Homing and Warning display. Two levels of pink noise (90 and 100 dB A-weighted) and two levels of sustained acceleration (2.75 and 3.75 Gz) served as the biodynamic stressors. Nine subjects performed the dual task in the Armstrong Aerospace Medical Research Laboratory human centrifuge. Exposures were 60 seconds long during which time subjects' noninvasive physiological parameters were monitored in either noise or acceleration conditions. The results indicate that biodynamic stressors such as noise and acceleration adversely affect subjective operator workload without affecting objective task performance and that physiological workload measures such as eye blink and blink duration are ineffective in the acceleration environment. GRA

N89-12202# Klein Associates, Yellow Springs, Ohio.
PREDICTION MODEL FOR ESTIMATING PERFORMANCE IMPACTS OF MAINTENANCE STRESS Interim Technical Paper, May - Oct. 1986
Janet Taynor, Gary A. Klein, and Cheryl L. Batchelor Jun. 1988 36 p
(Contract F33657-84-D-0315)
(AD-A196798; AFHRL-TP-88-5) Avail: NTIS HC A03/MF A01 CSCL 05I

An Identification Point modelling tool was constructed to assist Air Force planners to predict the effects of stress upon aircraft maintenance time. Preparedness for the hazard, experience of the maintenance technicians, payoff for performing the task quickly, task complexity, and the need for others to complete the task were combined to produce 32 identification points in the model. The Comparison Based Prediction method was used to obtain information from maintenance experts in industry, Air National Guard experts, and civilian fire vehicle maintainers. The model describes and predicts the effects upon maintenance time of various combinations of the five factors. Future combat conditions may expose maintenance technicians to hazards such as bombs, bullets, and nuclear/biological/chemical (NBC) warfare conditions. The speed and manner of aircraft maintenance task performance under these conditions are critical determinants of how fast aircraft can be returned to combat. The speed at which aircraft can be turned around during normal operations and during simulated surge conditions can be studied and the data used to calculate sortie rates. The study of performance of even routine maintenance tasks in this type of environment must take into account the effects of psychological stress. Because the effects of psychological stress upon maintenance personnel can have a critical impact upon the time needed to return aircraft to battle, the effect of such stress must be addressed. GRA

N89-12203# Naval Air Development Center, Warminster, Pa. Air Vehicle and Crew Systems Technology Dept.
FIRE TESTS OF ADVANCED ARAMID BLENDS AND TREATMENTS Final Report
George H. Kydd and Joan C. Marano-Goyco Dec. 1987 53 p
(AD-A197512; NADC-87179-60) Avail: NTIS HC A04/MF A01 CSCL 11E

Full scale fuel fire pit tests were performed on three different groups of flight suits. The purpose of these tests was to compare the fire protective quality, as related to percent body burned, or super flame-resistant nomex blends. The materials tested were: (1) Super flame resistant nomex, (2) PBI (Polybenzimidazole) - Super flame resistant nomex, (3) Super flame resistant nomex camouflage and (4) Nomex III, tested as a control. Nomex III is a 95/5 percent Nomex-Kevlar blend and is the standard sage green 27P flight suit currently being used by Navy and Air Force. The tests were conducted at the Naval Air Development Center's Facility and the suits were subjected to three second exposures using JP-4 fuel. One of the camouflage suits was tested at four seconds. GRA

N89-12204# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
ANTHROPOMETRY AND MASS DISTRIBUTION FOR HUMAN ANALOGUES. VOLUME 1: MILITARY MALE AVIATORS Final Report
Mar. 1988 76 p
(AD-A197650; AAMRL-TR-88-010-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 05I

Anthropometric and mass distribution data for use in constructing three-dimensional human analog, i.e., mathematical models or test dummies, are presented in this report. Included here are body dimensions, joint locations, and mass distribution properties appropriate for modeling the Small, Mid-size, and Large male aviator of the 1980s. The data were derived from: (1) 130 body dimensions of standing and seated males obtained by traditional anthropometric methods; (2) mass distribution data for body segments obtained by stereophotographic techniques; and (3) skeletal joint centers obtained by estimation. The anthropometric data, generated from multiple regressions on stature and weight, are suitable as the basis for models to be used in testing responses to impact and other mechanical forces; they are not recommended for other purposes such as the sizing of clothing and personal protective equipment, or workspace design. GRA

N89-12205# Army Research Inst. of Environmental Medicine, Natick, Mass.
THE PHYSIOLOGICAL DETERMINANTS OF LOAD BEARING PERFORMANCE AT DIFFERENT MARCH DISTANCES Technical Report, Sep. - Nov. 1986
Robert P. Mello, Andrew I. Damokosh, Katy L. Reynolds, Calvin E. Witt, and James A. Vogel Apr. 1988 38 p
(AD-A197733; USARIEM-T-15/88) Avail: NTIS HC A03/MF A01 CSCL 23B

The purpose of this study was to further knowledge of the physiological determinants of load bearing performance over distances from 2 to 12 km. Twenty eight soldiers, experienced in load bearing, were initially assessed for: aerobic power (VO2max), leg strength and muscular endurance, maximal lift capacity, maximal heart rate (HRmax), body composition, body anthropometry, and submaximal treadmill response to load bearing. Following a week of fitness assessment, each soldier performed four, best effort, load bearing trials at distances of 2, 4, 8 and 12 km. All trials were scheduled in random order on four successive weeks. The total load carried (pack, weapon, and clothing) was 46.12 kg. Mean performance times for each distance were 16.0, 35.1, 77.2 and 125.0 minutes, respectively. Mean exercise intensity (percent HRmax) as measured by HR telemetry for each trial was 74, 71, 69 and 63 percent respectively. GRA

N89-12206*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HAZARDS PROTECTION FOR SPACE SUITS AND SPACECRAFT Patent Application
Joseph J. Kosmo, inventor (to NASA) and Frederick S. Dawn, inventor (to NASA) 30 Jun. 1988 16 p
(NASA-Case-MSC-21366-1; NAS 1.71:MSC-21366-1; US-Patent-Appl-SN-213880) Avail: NTIS HC A03/MF A01 CSCL 06K

A flexible multi-layered covering for protection against the hazards of exposure to the environment of outer space is presented. The covering includes an outer layer section comprising an outmost lamina of woven expanded tetrafluorethylene yarns (Gore-Tex) for protecting against abrasion and tearing, an underlying weave of meta-aramid yarns (Nomex) and para-aramid yarns (Kevlar) for particle impact protection, an electrostatic charge dissipation and control system incoporated therein, and a chemical contaminants control barrier applied as a coating. A middle section includes a succession of thermal insulating layers of polymeric thermoplastic or thermoforming material, each of which is coated with a metal deposit of high infrared emissivity and low solar radiation absorption characteristics and separated from adjacent insulating layers by a low thermal conductance material. The covering includes a radiation attenuating layer of a tungsten-loaded polymeric elastomer binder for protecting against bremsstrahlung radiation and an inner layer of rip-stop polyester material for abrasion protection. A chloroprene coating may be supplied by polyester-material for added micrometeroid protection. Securing the means of low heat conductance material secures the multi-layers together as a laminar composite. NASA

N89-12207*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SURVEY OF SOME REGENERATIVE PHYSICO-CHEMICAL LIFE SUPPORT TECHNOLOGY
Theodore Wydeven Nov. 1988 43 p
(NASA-TM-101004; A-88189; NAS 1.15:101004) Avail: NTIS HC A03/MF A01 CSCL 06K

To date, manned spaceflight has used the relatively simple support methodology of bringing all the necessary water, oxygen, and food for the duration of the mission, and collecting and storing waste products for return to Earth. This is referred to as an open system. It was recognized early, as manned missions became longer and crew size increased, that the weight, volume, and transportation penalties of storing or routinely resupplying consumables would at some point become too expensive. Since the early 1960's regenerative ECLSS technology has been under development, and there now exists a foundation in both systems definition and subsystem technology to support long-duration manned missions. In many cases this development has reached the engineering prototype stage for physico-chemical subsystems and in this article some of these subsystems are described. Emphasis is placed on physico-chemical waste conversion and related processes which provide sustenance and not on environmental factors or subsystems, e.g., temperature and humidity control, spacecraft architecture, lighting, etc. Author

N89-12208# Southampton Univ. (England). Human Factors Research Unit.
PERFORMANCE WITH HELMET-MOUNTED SIGHTS
M. J. Wells and M. J. Griffin Sep. 1987 126 p
(ISVR-TR-152; ETN-88-93546) Avail: NTIS HC A07/MF A01

More than 30 experiments concerned with the effects of vibration, and other variables, on the use of helmet-mounted sights are presented. The other variables include target size, target position and target motion, reticle size, reticle position (elevation), reticle shape and the eye of presentation of the reticle (eye dominance), performing a secondary task (talking), type of seat, wearing personal equipment (life support jacket, helmet, oxygen mask), and helmet mass. Data are also provided on the possible use of the helmet-mounted sight during air-to-air engagements and on the benefits of the combined use of the head and eyes to track and acquire targets. Published studies of the use of the helmet-mounted sight in the laboratory and in-flight are reviewed. ESA

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N89-12209# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Mathematics.
PROCEEDINGS OF THE SUMMER SCHOOL IN NUMERICAL ANALYSIS AT HELSINKI 1987
Olavi Nevanlinna, ed. Feb. 1988 165 p Summer school held in Helsinki, Finland, 12-19 Aug. 1987
(PB88-194196; HTKK-MAT-C7; ISBN-951-754-406-5; ISSN-0784-6460) Avail: NTIS HC A08/MF A01 CSCL 12A

Analytical and numerical solutions to higher index linear variable coefficient DAE system is discussed. An acceleration scheme for iteration methods is also discussed along with Multigrid methods. For individual titles, see N89-12210 through N89-12220.

N89-12210# Umea Univ. (Sweden). Inst. of Information Processing.
ANALYTICAL AND NUMERICAL SOLUTIONS TO HIGHER INDEX LINEAR VARIABLE COEFFICIENT DAE SYSTEMS Abstract Only **c64**
Anders Barrlund and Bo Kagstroem *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 6-7 (For primary document see N89-12209 03-59)
(UMINF-134.87; ISSN-0348-0542) Avail: NTIS HC A08/MF A01 CSCL 12A

Analytical and numerical solutions to the singular linear system of differential equations are investigated. Closed form analytical solutions of systems transformable to standard canonical forms, SCF, are derived. Equivalent ways to compute the analytic solution are presented which are of interest in a symbolic/numeric computing environment. Many numerical methods for solving DAE systems are based on Gear's backward difference formula (BDF) method. It is proved that the BDF method and the modified BDF method, MBDF, are stable and O(h sup k) accurate after a maximum os (s-1)(k+1) steps for linear variable coefficient systems in SCF, where s is the dimension of the algebraic part. These new results are valid for arbitrarily higher index systems and generalize well known results for linear constant coefficient singular systems to the variable coefficient case. Numerical experiments confirm the order and stability results. Author

N89-12211# Kiel Univ. (West Germany). Praktische Mathematik.
MULTI-GRID METHODS Abstract Only **c61**
W. Hackbusch *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 11-12 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 09B

The construction of the multigrid algorithm starts from the observation that classical iteration schemes like damped Jacobi or Gauss-Seidel method, although they are very slow in general, are fast with respect to high frequency components. Therefore these classical iterations must be combined with a complementary scheme which reduces low frequencies. To this purpose, the coarse-grid correction is introduced. Smooth errors can be approximated very well by an analogous approximation in a coarse grid. The combination of the smoothing iteration with the coarse grid correction yields the two grid method. Solving the coarse grid equation recursively by the same iteration at the coarser level, one obtains the multigrid iteration. Author

N89-12212# Nokia Research Center, Espoo (Finland).
FEM SIMULATION MODEL FOR SIGNAL DELAY IN GENERAL DISTRIBUTED NETWORKS **c33**
Veikko Hara *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 13-24 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 09C

Distributed parameter elements are good models for polysilicon and diffusion lines are used as connecting wires in MOS integrated circuits. Simple bounds for the signal propagation delay in such networks are valuable in the timing analysis and in the simulation of digital MOS VLSI chips. In MOS interconnections the nonlinear capacitors usually appear, for example, as a nonlinear gate to the channel capacitance of a MOSFET load. The linear lines are considered with the telegraph equation model, linear resistors and nonlinear capacitors. Author

N89-12213# Jyvaskyla Univ. (Finland). Dept. of Mathematics.
ON STATE CONSTRAINED CONTROL PROBLEMS **c64**
Raino Makinen *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 25-29 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

State constrained control problems with control appearing in the coefficients of elliptic differential operators are considered. Numerical solution with finite elements and mathematical programming is studied using a simple model problem. Numerical results are presented. Author

N89-12214# Muenster Univ. (West Germany).
NUMERICAL METHOD IN COMPUTERIZED TOMOGRAPHY **c64**
F. Natterer *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 30-32 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

Tomography is a technique for imaging a single slice of a 3D object. In computerized tomography one scans the slice by a thin X-ray beam. This provides the values of the integrals of the attenuation distribution over the measured lines. The mathematical problem is to reconstruct the attenuation distribution from these line integrals. Author

N89-12215# Paris VI Univ. (France).
IRROTATIONAL AND WEAKLY IRROTATIONAL FLOWS **c34**
O. Pironneau *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 51-79 Prepared in cooperation with Institut National de Recherche d'Informatique et d'Automatique, Le Chesnay, France (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 20D

It is possible with suitable boundary conditions to find irrotational solutions (delta x u = 0) to the general fluid mechanics equations under the following hypothesis: nonviscous flow and no rotation generated by discontinuities (shocks). The finite element approximations of the equations are studied. The Neumann problem was examined, where the finite element method was recalled. Subsonic compressible flows were solved by an optimization method, which is then extended to transonic flows. The resolution of the problem was studied in stream functions as well as a rotational correction method based on the Helmholtz decomposition. Author

N89-12216# Saarland Univ., Saarbrucken (West Germany). Fachbereich Mathematik.
EXTRAPOLATION TECHNIQUES IN THE FINITE ELEMENT METHOD: A SURVEY **c64**
Rolf Rannacher *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 80-113 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

The Richardson extrapolation to the limit is a common way of increasing the accuracy of low order discretization methods in solving ordinary as well as partial differential equations. Its success depends on the presence of asymptotic expansions of the error with respect to certain powers of the mesh size. In more than one dimension the derivation of such expressions for finite difference schemes usually relies on some kind of discrete maximum principle, and therefore, is restricted to a very narrow class of problems. Recently, alternative methods were developed which are based on finite element techniques and do not use maximum principles. This approach yields error expansions also for the elliptic systems and higher order equations in continuum mechanics. These new results are surveyed and some of the open questions addressed. Author

N89-12217# Jyvaskyla Univ. (Finland).
ON OPTIMAL MESH DESIGN FOR FEM IN CONTACT PROBLEMS **c64**
Kimmo Salmenjoki *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 114-124 Sponsored by the Academy of Finland (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

The sensitivity analysis methods developed by J. Haslinger and P. Neittaanmaki and by M. Delfour, G. Payre, and J. P. Zolesio are extended to the case of finite element (FE)-grid optimization in elliptic contact problems. Problems of this kind were also considered by N. Kikuchi. The criteria used in grid optimization are the total potential energy of the system. It is shown that minimization of this cost functional means a decrease in the discretization error and at the same time a better approximation of the discrete contact set. Numerical results for the plane elasticity problem with unilateral boundary conditions are given. Author

N89-12218# Chalmers Univ. of Technology, Goeteborg (Sweden).
STREAMLINE DIFFUSION FINITE ELEMENT METHODS FOR HYPERBOLIC CONSERVATION LAWS **c64**
Anders Szepessy and Peter Hansbo *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 125-133 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

Recent work on the convergence of streamline diffusion (SD) finite element method (FEM) for hyperbolic conservation laws is reported. B.G.

N89-12219# Geneva Univ. (Switzerland).
STIFF DIFFERENTIAL EQUATIONS, STUDY OF ONE-STEP METHODS **c64**
G. Wanner *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 134-145 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

The numerical treatment of still differential equations struggles with a double difficulty: firstly, the need for extended stability (A-stability) leads to order bounds in the style of the Dahlquist second barrier; secondly, the classical order is then, in the presence of stiffness, further weakened by the phenomenon of order reduction. An introduction is given and numerical algorithms presented. Author

N89-12220# Chalmers Univ. of Technology, Goeteborg (Sweden).

SEMIDISCRETE L-SPLINE FINITE ELEMENT SCHEMES WITH HIGH SUPERCONVERGENCE AT THE NODES FOR PARABOLIC EQUATIONS IN ONE SPACE VARIABLE c64

Nai-Ying Zhang and Yishao Zhou (Royal Inst. of Tech., Stockholm, Sweden) *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 146-157 Prepared in cooperation with Goeteborg Univ., Sweden (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

A semidiscrete L-spline scheme is presented for the numerical approximation of the solution for a one-dimensional parabolic equation. The structure and size of the scheme are the same as that obtained from the standard linear finite element method thus providing an efficient way to yield high superconvergence at nodes. Required error estimates are determined and the use of the semidiscrete scheme with numerical integration is demonstrated. M.G.

N89-12221*# Boeing Computer Services Co., Seattle, Wash. Energy Technology Applications Div.

CORRECTION, IMPROVEMENT AND MODEL VERIFICATION OF CARE 3, VERSION 3 Interim Report

D. M. Rose, J. W. Manke, R. E. Altschul, and D. L. Nelson Dec. 1987 99 p
(Contract NAS1-16900)
(NASA-CR-166122-Rev; NAS 1.26:166122-Rev) Avail: NTIS HC A05/MF A01 CSCL 12A

An independent verification of the CARE 3 mathematical model and computer code was conducted and reported in NASA Contractor Report 166096, Review and Verification of CARE 3 Mathematical Model and Code: Interim Report. The study uncovered some implementation errors that were corrected and are reported in this document. The corrected CARE 3 program is called version 4. Thus the document, correction. improvement, and model verification of CARE 3, version 3 was written in April 1984. It is being published now as it has been determined to contain a more accurate representation of CARE 3 than the preceding document of April 1983. This edition supercedes NASA-CR-166122 entitled, 'Correction and Improvement of CARE 3,' version 3, April 1983. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N89-12222*# Georgia Inst. of Tech., Atlanta.

A SUPPORT ARCHITECTURE FOR RELIABLE DISTRIBUTED COMPUTING SYSTEMS Semiannual Status Reports, 9 Jun. 1987 - 8 Jun. 1988

Partha Dasgupta and Richard J. LeBlanc, Jr. 30 Sep. 1988 36 p
(Grant NAG1-430)
(NASA-CR-183235; NAS 1.26:183235) Avail: NTIS HC A03/MF A01 CSCL 09B

The Clouds project is well underway to its goal of building a unified distributed operating system supporting the object model. The operating system design uses the object concept of structuring software at all levels of the system. The basic operating system was developed and work is under progress to build a usable system. Author

N89-12223# Honeywell, Inc., Bloomington, Minn. Sensors and Signal Processing Lab.

OPTICAL SYMBOLIC PROCESSOR FOR EXPERT SYSTEM EXECUTION Quarterly Technical Report, 1 Dec. 1987 - 29 Feb. 1988

Aloke Guha 29 Feb. 1988 30 p
(Contract F49620-86-C-0082)
(AD-A196451; AFOSR-88-0616TR) Avail: NTIS HC A03/MF A01 CSCL 12G

The goal of this program is to develop a concept for an optical computer for symbolic computing by defining a computational model of a high level language, examining the possible devices for the ultimate construction of a processor, and by defining the required optical operations. The efforts in this quarter were in the design and analysis of electronic shuffle-exchange networks (SENs), the identification of the bottlenecks in the performance of the network, and the subsequent determination of the guidelines for implementing an optical SEN such that optics can address the electronic limitations and provide the capability of designing a high-performance network. The analysis of electronic SENs required designing the interface between the processors and the SEN, the smart exchange within the board. We considered both gallium arsenide and ECL technologies to determine the highest performance of an electronic SEN. GRA

N89-12224# University of Southern California, Marina del Rey. Information Sciences Inst.

ON THE DESIGN OF ISI's (INFORMATION SCIENCES INSTITUTE) INITIAL PROTOTYPE SDI ARCHITECTURE SIMULATOR

David Mizell, Yu-Wen Tung, Susan Coatney, Scott Carter, and Rivi Sherman Mar. 1988 57 p
(Contract N00014-86-R-0311)
(AD-A196610; ISI/RR-88-205) Avail: NTIS HC A04/MF A01 CSCL 15C

This report describes the software design of the first prototype strategic defense architecture simulation system developed under ISI's SDI Communications Research contract. While the long-term goal of the simulation task is to investigate techniques for speeding up simulators of this type via parallelism, this system is a sequential program in which it must be possible to: incorporate nontrivial, executable representations of the battle management computations taking place on any defense platform within the simulation; and change the candidate defense architecture being modeled independently of the simulation software that models the external physical environment. The report documents our approach to designing a simulator that meets those requirements. It includes both a description of the software design and some historical material about our design process: what design decisions we made, why we made them, and what alternatives were considered at the time. simulation. (edc) GRA

N89-12225# Southeastern Center for Electrical Engineering Education, Inc., St. Cloud, Fla.

INTEGRATED EXPERT SYSTEMS Final Report, Jun. 1986 - Jun. 1987

Stuart H. Hirshfield Mar. 1988 19 p
(Contract F30602-81-C-0193)
(AD-A196630; RADC-TR-87-250) Avail: NTIS HC A02/MF A01 CSCL 12E

This report presents an analysis of the current theoretical and practical states of what has been dubbed cooperating expert systems (COPES) technology - i.e., studies and experiments devoted to the problem of coordinating the communication and problem-solving activities of distinct expert (and non-expert) systems that already exist and that were developed independently. This problem is seen as distinct from those addressed by a number of more general technical approaches to achieving cooperation. The approaches, as represented by the blackboard architecture, the Airland Loosely Integrated Expert Systems (ALLIES) effort, the A Better Environment (ABE) effort, and the Multiple Node Expert System project, are described and evaluated in terms of their applicability to the existing system problem. A software architecture is proposed which combines aspects of these approaches to address a variety of practical tradeoffs that arise. Finally, a design technique that seems particularly suited to the architecture is described. GRA

N89-12226# Missouri Univ., Columbia. Dept. of Mathematics.
COMPUTER EXPERIMENTATION IN NON LINEAR ANALYSIS
Carmen Chicone 1987 16 p Presented at the Computer Experimentation in Non Linear Analysis Conference, Columbia, Mo., 4 Jun. 1987
(Contract DE-FG02-87ER-25040)
(DE88-013754; CONF-8706328-Absts) Avail: NTIS HC A03/MF A01

The purpose of the conference was to provide a forum for the exchange of scientific reports on some recent results in mathematics where computer experimentation or computer implementation plays a central role. In the appended material we have listed the public features of the conference: the schedule of events, the abstracts of the lectures and a list of participants. The main themes discussed were information compactification, chaos, computer algebra and computer graphics. DOE

N89-12227# Naval Postgraduate School, Monterey, Calif.
DESIGN, IMPLEMENTATION AND EVALUATION OF AN ABSTRACT PROGRAMMING AND COMMUNICATIONS INTERFACE FOR A NETWORK OF TRANSPUTERS M.S. Thesis
Gregory R. Bryant Jun. 1988 177 p
(AD-A197507) Avail: NTIS HC A09/MF A01 CSCL 12F

This thesis presents the design, implementation and evaluation of two abstracted programming and communication interfaces for developing distributed programs on a network of Transputers. One interface uses a shared memory model for interprocess communication and synchronization. The other interface uses a message passing model for communication and synchronization. The programming interfaces allow development of distributed programs that are independent of the physical configuration of a network. This thesis also presents an evaluation of Transputer performance with a particular emphasis on the interaction of computation and inter-Transputer communication. The Transputer is a single chip microprocessor that has been specifically designed to function as a computing element in a distributed multicomputer system. As the transistor was a building block for large and varied electronic circuits, the Transputer is intended by the manufacturer to be an analogous building block for distributed computing systems. To facilitate the use of the Transputer as an element in a distributed system, the Transputer implements the concept of Communicating Sequential Processes. Communicating Sequential Processes is a paradigm which defines and describes the interaction of programs that execute in parallel. GRA

N89-12228*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECIFICATION FOR WIDE CHANNEL BANDWIDTH ONE-INCH VIDEO TAPE
Jimmy L. Perry Oct. 1988 32 p
(NASA-TM-100712; NAS 1.15:100712) Avail: NTIS HC A03/MF A01 CSCL 09B

Standards and controls are established for the procurement of wide channel bandwidth one inch video magnetic recording tapes for Very Long Base Interferometer (VLBI) system applications. The Magnetic Tape Certification Facility (MTCF) currently maintains three specifications for the Quality Products List (QPL) and acceptance testing of magnetic tapes. NASA-TM-79724 is used for the QPL and acceptance testing of new analog tapes; NASA-TM-80599 is used for QPL and acceptance testing of new digital tapes; and NASA-TM-100702 is used for the QPL and acceptance testing of new IBM/IBM compatible 3480 magnetic tape cartridges. This specification will be used for the QPL and acceptance testing of new wide channel bandwidth one inch video magnetic recording tapes. The one inch video tapes used by the Jet Propulsion Lab., the Deep Space Network and the Haystack Observatory will be covered by this specification. These NASA stations will use the video tapes for their VLBI system applications. The VLBI system is used for the tracking of quasars and the support of interplanetary exploration. Author

N89-12229# Physics and Electronics Lab. TNO, The Hague (Netherlands).
AN ANALYSIS MODEL FOR THE SECURITY DESIGN OF COMPUTER AND COMMUNICATION SYSTEMS
F. G. J. vanAken, C. Eberwijn, and P. C. A. M. Karsten Jun. 1987 18 p
(FEL-1987-37; TD-87-4242; ETN-88-93407) Avail: NTIS HC A03/MF A01

In order to be able to define a security architecture for open computer and communication systems, security items involved are structured. Security threats in computer networks and the measures to be taken to provide a certain level of security are reviewed. The overall system is divided in subsystems with a horizontal and vertical segmentation method. The result is an analyzing method which can be used for the security design in computer and communication systems. ESA

N89-12230# Amsterdam Univ. (Netherlands). Logic and Computation Theory Group.
SPACE MEASURES FOR STORAGE MODIFICATION MACHINES
Peter vanEmdeBoas Nov. 1987 13 p Submitted for publication
(FVI-87-16; B8801173; ETN-88-93434) Avail: NTIS HC A03/MF A01

It is shown that constant factor space overhead simulations do not exist for pointer based models like the Storage Modification Machine and the Kolmogorov Uspenskii Machine under the uniform space measure. On these devices one can simulate S.log(S) squares of Turing Machine space in O(S) nodes. As a consequence one faces the choice of either using an less evident logarithmic space measure for pointer machines, or giving up the fundamental notion of invariance of space for sequential devices. ESA

N89-12294# Syracuse Univ., N. Y. Electrical and Computer Engineering.
COMPUTER ARCHITECTURES FOR VERY LARGE KNOWLEDGE BASES
P. Bruce Berra *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 835-851 (For primary document see N89-12284 03-63)
Avail: NTIS HC A21/MF A01 CSCL 09B

N89-12298# Syracuse Univ., N. Y. Logic Programming Research Group.
THE DESIGN AND IMPLEMENTATION OF A HIGH-SPEED INCREMENTAL PORTABLE PROLOG COMPILER
Kenneth A. Bowen, Kevin A. Buettner, Ilyas Cicekli, and Andrew Turk *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 901-921 (For primary document see N89-12284 03-63)
(Contract F30602-81-C-0159; AF-AFOSR-0292-82)
Avail: NTIS HC A21/MF A01 CSCL 09B

N89-12299# Syracuse Univ., N. Y. Logic Programming Research Group.
COMPILER OPTIMIZATIONS FOR THE WAM
Andrew K. Turk *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 915-921 (For primary document see N89-12284 03-63)
(Contract F30602-81-C-0169)
Avail: NTIS HC A21/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N89-12231# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF LINEARIZED KALMAN FILTER-SMOOTHER TO AIRCRAFT TRAJECTORY ESTIMATION M.S. Thesis
James M. Ruley Jun. 1988 161 p
(AD-A194362; AFIT/GAE/ENG/88J-1) Avail: NTIS HC A08/MF A01 CSCL 01C

The purpose of this study was to investigate the potential utility of the linearized Kalman filter-smoother as a tool for aircraft mishap investigations. The intention was to produce a computer analysis tool which could accurately reproduce the forcing functions required to generate a specified aircraft trajectory. This information is often of value to mishap investigation boards in determining probable pilot actions. The resulting algorithm was subjected to a noise strength sensitivity study, a measurement device precision study, and a study to determine the effects of multiple iterations of the algorithm. The evaluation showed that the algorithm performed well and generated useful results. However, limitations in the current implementation were discovered. As a result of these, the systematic generation of nominal trajectories and elimination of unrealistic output transients were identified as topics for further study. GRA

N89-12232# National Aeronautical Lab., Bangalore (India). Computer Centre.
GENERALIZED PROGRAM FOR FITTING MULTIPLE CURVES USING AD/380 CAD SYSTEM
N. Kumar and S. Janardhan Dec. 1987 29 p
(PD-CC-8706) Avail: NTIS HC A03/MF A01

Highly interactive quick actions have been developed for fitting smooth curves on multiple data sets residing as a disk file on the AD/380 system or as a tape file from a host system. Quick Actions have been developed in such a way that a single set of x-values can be plotted against as many as 30 different sets of y-values (say y sub 1, y sub 2 ....y sub 30), thus generating a maximum of 30 smooth curves. Author

N89-12233# Lawrence Livermore National Lab., Calif. Computing Research Group.
EXPERIENCE OF IMPLEMENTING APPLICATIVE PARALLELISM ON CRAY X-MP
Ching-Cheng Lee May 1988 8 p Presented at the CONPAR '88, Manchester, United Kingdom, 12-16 Sep. 1988 Submitted for publication
(Contract W-7405-eng-48)
(DE88-011728; UCRL-98303; CONF-880975-1) Avail: NTIS HC A02/MF A01

The traditional approach on Cray multiprocessing has been multitasking in FORTRAN environments with operating system support. This kind of approach usually requires explicit user intervention to restructure or reformulate the algorithms to control parallel execution. However, it is error-prone and in most cases, only coarse-grain parallelism such as subroutines or functions was explored. In this paper, an implemention of micro-tasking for an applicative language called SISAL on Cray X-MP is reported. The experience indicates where the automatic approach to parallelization works well, as well as sources of inefficient behavior on the Cray X-MP. The experience also suggests some future improvements of SISAL multiprocessing on Cray X-MP. DOE

N89-12234*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A METHOD FOR MONITORING THE VARIABILITY IN NUCLEAR ABSORPTION CHARACTERISTICS OF AVIATION FUELS
Danny R. Sprinkle and Chih-Ping Shen (Old Dominion Univ., Norfolk, Va.) 1988 28 p
(NASA-TM-4077; L-16497; NAS 1.15:4077) Avail: NTIS HC A03/MF A01 CSCL 09B

A technique for monitoring variability in the nuclear absorption characteristics of aviation fuels has been developed. It is based on a highly collimated low energy gamma radiation source and a sodium iodide counter. The source and the counter assembly are separated by a geometrically well-defined test fuel cell. A computer program for determining the mass attenuation coefficient of the test fuel sample, based on the data acquired for a preset counting period, has been developed and tested on several types of aviation fuel. Author

N89-12235# Lawrence Livermore National Lab., Calif.
SMOOTH APPEARANCE FOR POLYGONAL SURFACES
Nelson L. Max Jan. 1988 34 p Presented at the Association for Computing Machinery (SIGGRAPH '88), Atlanta, Ga., 1 Aug. 1988
(Contract W-7405-eng-48)
(DE88-005677; UCRL-97937; CONF-880829-1) Avail: NTIS HC A03/MF A01

Current shading methods for polygonal approximations to smooth surfaces reveal the polygon edges by lack of smoothness in the shading, texture, reflection lines, intersections, profiles, and shadows. These defects are eliminated here by interpolating the perspective depth in screen coordinates with a C^1 piecewise-polynomial function, defined over triangles in the screen plane. The three eye-space components of the surface normal, and the two texture parameters, are separately interpolated with similar C^1 functions. For smooth intersections, the depth comparison test of Watkins' polygon-based span-coherence scan-line algorithm is replaced by a simple test which uses closed-form solutions to polynomials of degree 2, 3, or 4. When the scan lines arise from scan planes containing the eye and the light source a version of the shadow volume algorithm can also generate smooth cast shadows. However, the C^1 functions do not give smooth profiles or boundaries edges. These must be approximated by suitable subdivision of the original polygons. DOE

N89-12236 Arizona Univ., Tucson.
INCREASING THE PROPENSITY TO USE COMPUTER APPLICATION SOFTWARE Ph.D. Thesis
Richard Emerson Yellen 1987 283 p
Avail: Univ. Microfilms Order No. DA8804194

The use of computer application software could be increased. The goal was to uncover a design for a module which instructs the potential user how to use the software. Four instructional module designs, which were the result of combining two states of variables of instructional module design, were examined. The four designs are: an automated programmed learning module; an automated help facility; a manual programmed learning module; and a manual help facility. A financial decision support tool was developed, and each of the four instructional module designs was placed separately on the decision support tool. This created, in effect, four different tools. Dissert. Abstr.

N89-12237*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS OF POSITRON LIFETIME SPECTRA IN POLYMERS
Jag J. Singh, Gerald H. Mall (Computer Sciences Corp., Hampton, Va.), and Danny R. Sprinkle Dec. 1988 61 p
(NASA-TP-2853; L-16468; NAS 1.60:2853) Avail: NTIS HC A04/MF A01 CSCL 09B

A new procedure for analyzing multicomponent positron lifetime spectra in polymers was developed. It requires initial estimates of the lifetimes and the intensities of various components, which are readily obtainable by a standard spectrum stripping process. These initial estimates, after convolution with the timing system resolution function, are then used as the inputs for a nonlinear least squares analysis to compute the estimates that conform to a global error minimization criterion. The convolution integral uses the full experimental resolution function, in contrast to the previous studies where analytical approximations of it were utilized. These concepts were incorporated into a generalized Computer Program for Analyzing Positron Lifetime Spectra (PAPLS) in polymers. Its validity was tested using several artificially generated data sets. These data sets were also analyzed using the widely used POSITRONFIT program. In almost all cases, the PAPLS program gives closer fit to the input values. The new procedure was applied to the analysis of several lifetime spectra measured in metal ion containing Epon-828 samples. The results are described. Author

N89-12238# National Aeronautical Lab., Bangalore (India). Systems Engineering Div.

ESTIMATION OF STATES OF AIRCRAFTS BY KALMAN FILTERING ALGORITHMS

V. Parameswaran, U. C. Niranjan, and J. R. Raol Jul. 1988 34 p
(PD-SE-8810) Avail: NTIS HC A03/MF A01

The theory of optimal estimation has applications to a broad range of problem areas. Given the system model and noisy measurements, with known statistical properties of the noise in system dynamics and measurement devices, and initial condition information, an optimal state estimation algorithm obtains minimal variance estimates of the states of a linear system. State estimation techniques find extensive use in many areas: chemical processes, nuclear reactors, telecommunications, and aerospace vehicles. The problem of estimation of states of aircrafts is addressed using both real and simulated data. The data used for state estimation pertained to both short period and phugoid longitudinal modes of the aircraft. The state model used in the filter algorithm makes use of the parameters determined from the simulated/real data by maximum likelihood estimation (MLE) algorithm. The state estimation becomes necessary in case of postflight data analysis. This is because the acquired data are contaminated by random noise, measurement errors and biases. In this context, it was felt necessary to develop and utilize Kalman filter type algorithms to serve the need as starting and complementary algorithms for obtaining complete analysis of postflight data. A recent algorithm based on the concept of modifiable nonlinearity has been employed to handle real flight data, not only to filter the states (prefiltering mode) but also to estimate stability and control derivatives of an aircraft (complementary mode to MLE). Author

N89-12239# Sandia National Labs., Albuquerque, N. Mex.

MIDAS: MULTIPLE INSTRUMENT DATA ACQUISITION SOFTWARE USER GUIDE

Kenneth A. Mikkelson Aug. 1988 34 p
(Contract DE-AC04-76DP-00789)
(DE88-014703; SAND-88-1115) Avail: NTIS HC A03/MF A01

MIDAS (Multiple Instrument Data Acquisition Software) is a software package which supports data acquisition and analysis. It is similar in function to AQD but is written in SPS Basic, is simpler to operate, and provides an alternative approach when AQD is not appropriate. MIDAS can support a wide variety of recorders, and can be used in either stand-alone or networked systems. Also, adding new recording instruments to the package can be accomplished with minimal effort. DOE

N89-12240# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SOFTWAVE DESIGN FOR THE CENTRO DE MISSAO DE COLETO DE DADOS M.S. Thesis [PROJETO DE SOFTWARE PARA UM CENTRO DE MISSAO DE COLETA DE DADOS]

Jose doPatrocinioMoraisdeSouza Aug. 1988 234 p In PORTUGUESE; ENGLISH summary
(INPE-4648-TDL/339) Avail: NTIS HC A11/MF A01

The Centro de Missao de Coleta de Dados (Data Acquisition Center) receives and processes the data transmitted by the data collecting satellite of the Missao Espacial Completa Brasiliera (Brazilian Space Mission Complex) holding them available for remote user accesses through telex and/or telephone lines. The software to be developed presents real time processing characteristics. The purpose of this work is to perform the analysis and design phases of this system proposing a specific methodology which includes real time systems and data base design techniques. Author

N89-12241# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

DRAWING OF VECTOR FIELDS WITH THE INPE SYMBOL

Kioshi Hada Sep. 1988 19 p In PORTUGUESE; ENGLISH summary
(INPE-4698-RPE/576) Avail: NTIS HC A03/MF A01

A program for ploting vector fields on grid points in equatorial mercator projection, a theory and a program for drawing the INPE's symbol are presented. Author

N89-12242# University of Southern California, Marina del Rey. Information Sciences Inst.

NOTECARDS: AN EVERYDAY TOOL FOR AIDING IN COMPLEX TASKS

Brian Harp and Robert Neches Mar. 1988 25 p
(Contract MDA903-86-C-0178)
(AD-A196580; ISI/RS-88-204) Avail: NTIS HC A03/MF A01 CSCL 12E

Most current notecard systems don't take advantage of the semistructured nature of notes, making retrieval and analysis difficult and requiring manual maintenance of the notes contained in the system. In addition, all current notecard systems are self-contained, forcing the user to maintain the relationships between notes and the domain knowledge bases. By exploiting the semistructured nature of notes, it is shown that notes can aid in several areas, including: capturing information not typically in intelligent systems, accessing that information, graceful degradation in intelligent systems, and reasoning using this additional knowledge. A system is proposed that contains structures for capturing semistructured information, a number of note types useful in reasoning in varied domains, and the control mechanisms necessary in a notecard environment. A prototype has been built and integrated with a knowledge base browsing tool, and is currently being expanded in capability as well as being integrated into a second domain. GRA

N89-12243# Colorado Univ., Boulder. Dept. of Computer Science.

GENERATING FAST, ERROR RECOVERING PARSERS Final Report M.S. Thesis

Robert W. Gray 1987 66 p
(Contract N00014-86-K-0204)
(AD-A196581) Avail: NTIS HC A04/MF A01 CSCL 12E

A parser is the part of a compiler that recognizes the structure of the input language. It should be time and space efficient and user friendly that is, present clear and concise diagnostics for syntax errors. A parser should also be maintainable; that is, a small change or fix should only require a small amount of effort. Although parser generators have provided significant power for language recognition tasks, many of them are deficient in error recovery. Of the ones that do provide error recovery, many of these produce unacceptably slow parsers. I have designed and implemented a parser generator that produces fast, error recovering parsers. The high speed of the parser is a result of making the code directly executable, and paying careful attention to implementation details. The error recovery technique guarantees that a syntactically correct parse tree will be delivered after parsing has completed no matter what the input. This is important so that remaining compilation phases will not have to deal with infinitely many special cases of incorrect parse trees. Measurements show that the generated parser runs faster than any other parser examined, including hand-written recursive descent parsers. The cost of this fast parser is a slight increase in space requirements. Although this particular generator requires LL grammars, the ideas can be applied to generators taking LAR grammars. GRA

N89-12244# Air Force Operational Test and Evaluation Center, Kirtland AFB, N. Mex.
SOFTWARE MAINTAINABILITY - EVALUATION GUIDE, VOLUME 3
28 Jan. 1988 223 p
(AD-A196597; AFOTEC-PAM-800-2-Vol-3) Avail: NTIS HC A10/MF A01 CSCL 12E

The purpose of this document is to provide the software evaluator the information needed to conduct the Air Force Operational Test and Evaluation Center's (AFOTEC's) software maintainability evaluation process. Software maintainability is limited in scope to software design and documentation assessments. This volume is an evolutionary document that will be updated periodically. Questions contained are intended to be only a representative sample of software maintainability questions. This version incorporates previous user comments, and we solicit your written inputs for the next update. This volume is one in a series of Software Operational Test and Evaluation Guidelines prepared by the Software Evaluation Division of the Logistics Directorate. It is intended for use in the operational test and evaluation of software. Comments should be directed to the Office of Primary Responsibility. GRA

N89-12245# Air Force Operational Test and Evaluation Center, Kirtland AFB, N. Mex.
SOFTWARE SUPPORT RESOURCES EVALUATION GUIDE, VOLUME 5
2 May 1988 52 p
(AD-A196598; AFOTEC-PAM-800-2-Vol-5) Avail: NTIS HC A04/MF A01 CSCL 12E

The Air Force Operational Test and Evaluation Center's (AFOTEC) approach to software operational test and evaluation (OT&E) has evolved since 1976. This evolution has resulted in structured tools and management techniques that permit consistent evaluations of various computer system applications. This volume describes a standardized technique for evaluating the software support resources (SSR) for mission critical computer resources (MCCR). A typical system may include several mission critical computers. An SSR evaluation may be targeted at each MCCR within a system or at the system of computer resources as whole. This guide is divided into the following chapters: Chapter 1 provides general information about the evaluation methodology; Chapter 2 provides guidance for the Headquarters (HQ) AFOTEC software evaluation manager and OT&E test team deputy for software evaluation (DSE) in planning and conducting the software support resources evaluation; and Chapter 3 gives specific guidance for the software evaluation members in accomplishing the software support resources evaluation. GRA

N89-12246*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STANDARD UTM-TO-GEO/GEO-TO-UTM COORDINATE CONVERSION ALGORITHMS
David Bernath 18 Sep. 1987 47 p
(Contract NAS7-918)
(NASA-CR-184579; JPL-D-4758; NAS 1.26:184579; ALGO-PUB-0132) Avail: NTIS HC A03/MF A01 CSCL 08B

The purpose of this document is to present an analysis of the standard algorithms used to convert the location of a point on the earth's surface from geographic coordinates (latitude/longitude) to Universal Transverse Mercator Grid form (easting/northing), and back again. This report treats only the problem of transforming UTM to Lat-Long and vice versa. The companion problem - which spheroids to use in different parts of the world - is not addressed. The computed terms are expanded in the standard series (See Army Tech Manual No. 5-241-8). These terms are then examined numerically to determine which are necessary for a given accuracy. The analysis shows how 1 meter accuracy in Northern and Eastern or in Lat-Long can be obtained. GRA

N89-12247# Applied Research Lab., State College, Pa.
AN ALGORITHM FOR SELECTING TRANSDUCER ELEMENT ARRAY POSITIONS M.S. Thesis
King W. Wiemann Jun. 1988 159 p
(AD-A196767; ARL/PSU/TR-88-005) Avail: NTIS HC A08/MF A01 CSCL 12E

A two-part technique to determine the placement of transducer elements in an array which minimizes the impact of element tolerances on the directional beam pattern has been developed. This technique has been used to place in an array elements with tolerances of + or - 9 percent in amplitude and + or - 11 deg in phase. The resulting theoretical array response achieved side lobe levels that were within 1 dB of the -40 dB design. The first half of the technique selects four elements at a time from a larger selection pool, and places them in symmetric positions about the center of the array in a manner that partially cancels their respective amplitude and phase variations. The second half of the technique uses a Permutation Search algorithm which rearranges the initial placement of elements in and out of the array looking for improvements in the array response. A lumped-parameter equivalent circuit of a tonpilz transducer is used to predict element amplitude and phase tolerances for different radiation loadings, based on in-air measurements of the transducers. Relationships among the measurable parameters of a transducer and its performance characteristics have been explored. Preliminary estimates of acceptable tolerances for each circuit parameter have been established. GRA

N89-12248# Lawrence Livermore National Lab., Calif.
ALPAL: A TOOL FOR THE DEVELOPMENT OF LARGE-SCALE SIMULATION CODES
Grant O. Cook, Jr. 22 Aug. 1988 110 p
(Contract W-7405-eng-48)
(DE88-016044; UCID-21482) Avail: NTIS HC A06/MF A01

This document introduces A Livermore Physics Applications Language (ALPAL), a new computer language developed by the author. ALPAL is geared for use by expert computational physicists as a significant aid in building complex simulation programs. Notably, ALPAL generates almost all of the FORTRAN code needed to carry out the simulation indicated by the physics model that is given as input. However, ALPAL is a research code, and as such, many more capabilities are being added to it, including extending its ability to generate code for other parts of a physics simulation program. In order to make the importance of this new language very clear, this report includes a survey of some of the languages and tools that have been developed to aid the computational physicist in simulation work. When the capabilities of these languages are examined, it becomes clear that the powerful new language ALPAL has broken significant new ground. DOE

N89-12249# Stanford Univ., Calif. Systems Optimization Lab.
A PRACTICAL ANTI-CYCLING PROCEDURE FOR LINEAR AND NONLINEAR PROGRAMMING
Philip E. Gill, Walter Murray, Michael A. Saunders, and Margaret H. Wright Jul. 1988 33 p
(Contract DE-FG03-87ER-25030)
(DE88-016684; SOL-88-4) Avail: NTIS HC A03/MF A01

A new method is given for preventing the simplex method from cycling. Key features are that a positive step is taken at every iteration, and nonbasic variables are allowed to be slightly infeasible. There is no additional work per iteration. Computational results are given for the first 53 test problems in NETLIB, indicating reliable performance in all cases. The method may be applied to active-set methods for solving nonlinear programs with linear constraints. DOE

N89-12250# Stanford Univ., Calif. Dept. of Operations Research.
INTERIOR-POINT METHODS FOR LINEAR PROGRAMMING: A CHALLENGE TO THE SIMPLEX METHOD
Philip E. Gill, Walter Murray, and Michael A. Saunders Jul. 1988 16 p
(Contract DE-FG03-87ER-25030)
(DE88-016686; SOL-88-14) Avail: NTIS HC A03/MF A01

The world of mathematical programming has seen a remarkable surge of activity following publication of Karmarkar's projective algorithm in May 1984. A review of the ensuing three years has already appeared. One year later, we review some of the main methods and surrounding events, and focus on references that contain computational results. DOE

N89-12251# Sandia National Labs., Albuquerque, N. Mex. Applied Mechanics Div.
ALGEBRA: A PROGRAM THAT ALGEBRAICALLY MANIPULATES THE OUTPUT OF A FINITE ELEMENT ANALYSIS (EXODUS VERSION)
Amy P. Gilkey Aug. 1988 46 p
(Contract DE-AC04-76DP-00789)
(DE88-016864; SAND-88-1431) Avail: NTIS HC A03/MF A01

The ALGEBRA program allows the user to manipulate data from a finite element analysis before it is plotted. The finite element output data is in the form of variable values (e.g., stress, strain, and velocity components) in an EXODUS database. The ALGEBRA program evaluates user-supplied functions of the data and writes the results to an output EXODUS database which can be read by plot programs. DOE

N89-12252# Sandia National Labs., Albuquerque, N. Mex. Computer Aided Engineering Div.
AN OVERVIEW OF THE COMPUTER AIDED DESIGN SYSTEM FOR DRAFTING AT SANDIA NATIONAL LABORATORIES, LIVERMORE
Bruce E. Koopmann Aug. 1988 27 p
(Contract DE-AC04-76DR-00789)
(DE88-016866; SAND-88-8941) Avail: NTIS HC A03/MF A01

Sandia Laboratories Livermore is converting the existing Computervision computer aided definition system (CADS) to a new hardware and software platform. This report describes the final configuration (after the conversion is completed) and the individual units comprising the system. A background describing the evolution of CADS at SNLL is appended. DOE

N89-12253# Illinois Univ., Urbana. Coordinated Science Lab.
SCALING OF LINEAR PROGRAMS
Milind A. Sohoni May 1988 38 p
(Contract N00014-85-K-0570)
(AD-A197548; UILU-ENG-88-2225; ACT-91) Avail: NTIS HC A03/MF A01 CSCL 12D

The scaling technique has been used often in designing efficient algorithms for combinatorial optimization problems. This thesis unifies problem-specific scaling approaches into a linear programming framework. Solution of linear programs by scaling involves successive solutions of what we call the timing problem. This tuning problem arises when one transforms a solution for the previous scale into a solution for the next scale. It is shown that the tuning problem has a nice format under certain assumptions, and it is precisely this convenience which has led to fast scaling algorithms for many combinatorial problems. The author also examines schemes that use a relaxation of complementary slackness, and shows that one such scheme is equivalent to scaling. He proposes a generalization of an approximation algorithm by Gabow and Tarjan and discusses its application to the tuning problem. Finally, he discusses scaling of the shortest path problem and the weighted matching problem in this linear programming framework. GRA

N89-12254# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.
A NEUTRON COMPUTER TOMOGRAPHY CODE BASED ON THE ALGEBRAIC RECONSTRUCTION TECHNIQUE (NCT-ART)
A. Krueger 1988 40 p Original contains color illustrations
(GKSS-88/E/14; ISSN-0344-9629; ETN-88-93200) Copyright Avail: NTIS HC A03/MF A01

A computer code which calculates two-dimensional cuts of material assemblies from a number of neutron radiographic projections is presented. Mathematically, the reconstruction is performed by an iterative solution of a system of linear equations. If the system is fully determined, clear pictures are obtained. Even for an underdetermined system (low number of projections) reasonable pictures are reconstructed, but picture artefacts and convergence problems occur increasingly. ESA

N89-12255# CISI Ingenierie, Toulouse (France).
STUDY OF THE DEVEOPMENT OF ON-BOARD DISTRIBUTED SOFTWARE SYSTEMS USING Ada
Bertrand PorcherLabreuille and Alberto DellaTorre Paris, France ESA May 1988 71 p Prepared in cooperation with Carlo Gavazzi Controls S.p.A., Milan, Italy
(Contract ESA-6572/85-NL-PP)
(ESA-CR(P)-2651; ETN-88-93247) Avail: NTIS HC A04/MF A01

Use of Ada technology for the design and implementation of large distributed systems in the context of the Columbus space station program was assessed by developing in Ada a prototype of an on-board data management system (DMS). Results and lessons learnt by applying a virtual node approach together with hierarchical object oriented design contribute to a better understanding and management of the use of Ada technology. This approach provides the definition of a development framework very well adapted to the Columbus DMS context. By defining applications and services software as Ada virtual nodes it is possible to design the whole system as a single Ada program, structured according to the architecture adopted for DMS. The applications could be developed in parallel on geographically distributed sites and be validated individually using this initial model and the corresponding interface specification. The final integration process could concentrate on the operational validation of the system in distributed configuration (the functional validation in centralized configuration being obtained at the end of the first phase). The efficient implementation of this method requires support tools for: checking the rules imposed by the virtual node approach; and scanning virtual node specifications (Ada packages) in order to generate a surrogate software layer to provide syntactically transparent communication between virtual nodes located on distinct physical processors. ESA

N89-12256# Institut National Polytechnique, Grenoble (France).
CONTRIBUTION TO THE TREATMENT OF DISCRETE FORMS. SKELETONS AND GRAPH CODING OF THE MEDIAL LINE Ph.D. Thesis [CONTRIBUTION AU TRAITEMENT DE FORMES DISCRETES. SQUELETTES ET CODAGE PAR GRAPHE DE LA LIGNE MEDIANE]
Annick Montanvert 1987 186 p In FRENCH; ENGLISH summary
(ETN-88-93263) Avail: NTIS HC A09/MF A01

In the frame of discrete binary image analysis, a method to describe and manipulate the objects contained in the image is presented. The calculation of a medial line, and then of a graph of the medial line leads to a hierarchical representation of the medial axis which contributes to the structured analysis of the original object. Different procedures of shape manipulation are tested and proposed, including progressive reconstruction, filtering and decomposition. An application, consisting of determining the trajectory of an ocean-bottom mining device is described. ESA

N89-12257# Grenoble-1 Univ. (France). Techniques de l'Informatique, des Mathematiques, de la Microelectronique et de la Microscopie Quanti
SEQUENCING SYSTOLIC ALGORITHMS [SEQUENTIALISATION D'ALGORITHMES SYSTOLIQUES]
A. Benaini and M. Tchuente Apr. 1988 19 p In FRENCH; ENGLISH summary
(RR-718-M; ETN-88-93269) Avail: NTIS HC A03/MF A01

A solution to prove if a given systolic algorithm implements correctly a sequential algorithm is proposed. The method consists of a sequentialization of the systolic algorithm. The first step describes the network, the second sequentializes this description. The SISYC2 computer program which performs this sequencing is presented. Examples concerning matrix products and triangular matrices in networks are given. ESA

N89-12258# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Sciences.

WELL-FOUNDED RECURSION IN TYPE THEORY

Erik H. Saaman and Grant R. Malcolm 1987 34 p

(CS-8710; ETN-88-93355) Avail: NTIS HC A03/MF A01

The type introduced by Nordstrom (1987) into Martin-Lof's theory of types is shown to formalize the notion of well-founded induction and thus constitute a powerful tool for the derivation of terminating general recursive functions. Nordstrom's type is used to characterize well-founded relations. The well-foundedness of several relations is proved. Once these relations are proved well-founded, they may the more easily be used in deriving programs. Examples demonstrate the facility with which Nordstrom's type allows recursive functions to be derived. ESA

N89-12259# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Sciences.

AN EFFICIENT PENUMBRA ALGORITHM

Menno T. Kosters 1988 22 p Original contains color illustrations

(CS-8801; ETN-88-93357) Avail: NTIS HC A03/MF A01

An algorithm for drawing shaded images including penumbrae is described. Light sources and objects are assumed to be convex polyhedra. Efficiency is achieved first by a preprocessing step which identifies pixels for which the actual pneumbra computations have to be done, and second by employing an efficient polygon clipping algorithm for determining the visible part of light sources. Correctness proofs of the geometric algorithms involved are stressed. ESA

N89-12260# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.

THE CONSTRUCTION OF A COMPACT AUTOMATON FOR THE TRANSLATION OF REGISTER TRANSFERS INTO MACHINE INSTRUCTIONS

Jan H. Jongejan, Eelco J. Dijkstra, and Doeke D. deVries 1988 26 p

(CS-8803; ETN-88-93359) Avail: NTIS HC A03/MF A01

A method for automatic construction of an automaton realized by transforming the machine description into a grammar that is suitable as input for a lexical-analyzer generator is presented. The target machine description, and the construction of an automaton from the machine description are outlined. The inherent ambiguities in the target machine description are analyzed. It is shown how register transfers are translated into machine code using the generated automaton. ESA

N89-12261# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.

QUADRATIC BLENDING SURFACES FOR COMPLEX CORNERS

Menno T. Kosters 1988 14 p

(CS-8804; ETN-88-93360) Avail: NTIS HC A03/MF A01

The potential method for blending implicitly defined surfaces is extended. It is shown how to blend an arbitrary number of surfaces forming a convex corner. Blending surfaces are constructed for all cases where three surfaces meet transversely. In all cases only quadratic blending are needed. The second construction relies heavily on a simple property of quadratic surfaces which shows that it is easy to attach cylinders smoothly to them. Numerical examples are included. ESA

N89-12262# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.

DO-IT-YOURSELF TYPE THEORY

Roland Backhouse, Paul Chisholm, and Grant Malcolm 1988 85 p

(CS-8805; ETN-88-93361) Avail: NTIS HC A05/MF A01

The notion of propositions as types, fundamental to Martin-Lof's theory of types, is discussed, showing the different judgement forms, in particular the membership judgement form. The elegant structure of the rules which characterizes Martin-Lof's theory is shown, and it is described how the elimination and computation rules for a given type constructor are derived from its formation and introduction rules, for free type structures, for congruence types, and for types with information loss. The mechanisms for deriving basic properties of type constructors closure, individuality, and cancellation properties are also considered. The way that algorithm development is conducted in a constructive framework is illustrated, particularly the relationship between the formulation of inductive hypotheses and the construction of invariant properties. Two ways of defining and reasoning about binary numerals are compared. Constructive reasoning on mutually recursive type structures is treated. ESA

N89-12263# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

PRELIMINARY DESIGN METHOD BASE SYSTEM

J. J. P. vanHulzen 30 Mar. 1987 75 p In DUTCH; ENGLISH summary

(NLR-TR-87052-U; B8817904; ETN-88-93380) Avail: NTIS HC A04/MF A01

An infrastructure for the development of information systems is discussed. A component in the infrastructure is the method base system, designed to support the management and use of algorithms implemented in programs. The preliminary design analyzes the functions of the method base system and elaborates on issues for the technical concept. It is found that this concept can be fit into the overall concept defined in the plan for the informatics policy. Plans for implementing and realizing the method base system are defined. ESA

N89-12264# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

THE INTERACTING MULTIPLE MODEL ALGORITHM FOR SYSTEMS WITH MARKOVIAN SWITCHING COEFFICIENTS

H. A. P. Blom and Y. Bar-Shalom (Connecticut Univ., Storrs.) 10 Sep. 1987 20 p Submitted for publication

(Grant AF-AFOSR-0112-84)

(NLR-MP-86061-U; B8805844; ETN-88-93388) Avail: NTIS HC A03/MF A01

The problem in filtering for linear systems with Markovian switching coefficients (dynamic Multiple Model systems) of management of hypotheses, which is necessary to limit the computational requirements, is addressed, and an approach to hypotheses merging is presented. The timing of hypotheses merging is emphasized. When applied to the problem of filtering for a linear system with Markovian coefficients this yields an elegant way to derive the Interacting Multiple Model (IMM) algorithm. Evaluation of the IMM algorithm shows that it performs very well at a relatively low computational load. These results imply a significant change in the state of the art of approximate Bayesian filtering for systems with Markovian coefficients. ESA

N89-12265# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

MULTISPECTRAL DATA COMPRESSION USING AN ADAPTIVE SPECTRAL TRANSFORM

W. C. Huisman 15 Jun. 1987 9 p Presented at the 6th Action Symposium on Signal Theory (Multidimensional Signals and Image Processing), Aachen, Fed. Republic of Germany, 9-12 Sep. 1987

(Contract ESA-5724/83-NL-BI)

(NLR-MP-87036-U; B8809801; ETN-88-93406) Avail: NTIS HC A02/MF A01

An implementable adaptive transform that can be used to improve the performance of data compression algorithms operating on data from multispectral sensors is presented. Results are compared with rate-distortion functions computed for data with Markovian properties. It appears that maximum improvement can be reached when using this transform depending on the number of sensors. ESA

N89-12266*# Worcester Polytechnic Inst., Mass. Intelligent Machines Project.
EVIDENCE FLOW GRAPH METHODS FOR VALIDATION AND VERIFICATION OF EXPERT SYSTEMS Final Report
Lee A. Becker, Peter G. Green, and Jayant Bhatnagar 11 Nov. 1988 46 p
(Grant NAG1-809)
(NASA-CR-183399; NAS 1.26:183399; IMP-8809) Avail: NTIS HC A03/MF A01 CSCL 09B

This final report describes the results of an investigation into the use of evidence flow graph techniques for performing validation and verification of expert systems. This was approached by developing a translator to convert horn-clause rule bases into evidence flow graphs, a simulation program, and methods of analysis. These tools were then applied to a simple rule base which contained errors. It was found that the method was capable of identifying a variety of problems, for example that the order of presentation of input data or small changes in critical parameters could effect the output from a set of rules. Author

N89-12267*# .National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMMON GRAPHICS LIBRARY (CGL). VOLUME 1: LEZ USER'S GUIDE
Nancy L. Taylor, Dana P. Hammond, Alicia S. Hofler, and David L. Miner (Computer Sciences Corp., Hampton, Va.) Sep. 1988 339 p
(NASA-TM-100626; NAS 1.15:100626; CSCC-G-12) Avail: NTIS HC A15/MF A01 CSCL 09B

Users are introduced to and instructed in the use of the Langley Easy (LEZ) routines of the Common Graphics Library (CGL). The LEZ routines form an application independent graphics package which enables the user community to view data quickly and easily, while providing a means of generating scientific charts conforming to the publication and/or viewgraph process. A distinct advantage for using the LEZ routines is that the underlying graphics package may be replaced or modified without requiring the users to change their application programs. The library is written in ANSI FORTRAN 77, and currently uses a CORE-based underlying graphics package, and is therefore machine independent, providing support for centralized and/or distributed computer systems. Author

N89-12268*# Hawaii Univ., Manoa. Dept. of Electrical Engineering.
A CONCATENATED CODED MODULATION SCHEME FOR ERROR CONTROL
Shu Lin 25 Sep. 1988 43 p
(Grant NAG5-931)
(NASA-CR-183006; NAS 1.26:183006) Avail: NTIS HC A03/MF A01 CSCL 09B

A concatenated coded modulation scheme for error control in data communications is presented. The scheme is achieved by concatenating a Reed-Solomon outer code and a bandwidth efficient block inner code for M-ary PSK modulation. Error performance of the scheme is analyzed for an AWGN channel. It is shown that extremely high reliability can be attained by using a simple M-ary PSK modulation inner code and a relatively powerful Reed-Solomon outer code. Furthermore, if an inner code of high effective rate is used, the bandwidth expansion required by the scheme due to coding will be greatly reduced. The proposed scheme is very effective for high speed satellite communications for large file transfer where high reliability is required. A simple method is also presented for constructing codes for M-ary PSK modulation. Some short M-ary PSK codes with good minimum squared Euclidean distance are constructed. These codes have trellis structure and hence can be decoded with a soft decision Viterbi decoding algorithm. Furthermore, some of these codes are phase invariant under multiples of 45 deg rotation. Author

N89-12269*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USER'S MANUAL FOR EZPLOT VERSION 5.5: A FORTRAN PROGRAM FOR 2-DIMENSIONAL GRAPHIC DISPLAY OF DATA
Charles Garbinski, Paul C. Redin, and Gerald D. Budd Oct. 1988 45 p
(NASA-TM-88293; H-1410; NAS 1.15:88293) Avail: NTIS HC A03/MF A01 CSCL 09B

EZPLOT is a computer applications program that converts data resident on a file into a plot displayed on the screen of a graphics terminal. This program generates either time history or x-y plots in response to commands entered interactively from a terminal keyboard. Plot parameters consist of a single independent parameter and from one to eight dependent parameters. Various line patterns, symbol shapes, axis scales, text labels, and data modification techniques are available. This user's manual describes EZPLOT as it is implemented on the Ames Research Center, Dryden Research Facility ELXSI computer using DI-3000 graphics software tools. Author

N89-12270# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
CONTRIBUTION TO THE REALIZATION OF SKEW SURFACES ON NUMERICAL CONTROLLED MACHINE TOOLS Ph.D. Thesis
Abdelkrim Ighilaza 17 Jun. 1988 97 p In FRENCH; ENGLISH summary
(IDI1-88-07; ETN-88-93284) Avail: NTIS HC A05/MF A01

To define the optimal roughness, it is considered that the final shape to realize is defined by placing side by side squares characterized by parametric polynomial functions with vectorial coefficients. The envelope volume is searched in reference to standard products after facetting the sculptured shape. The approach allows to pass from a sculptured face defined initially by parts to a general model of this surface. The developed model takes into account the necessary clamping volume. It also makes possible the automatic generation of rough shape passes with a high rate using a two size milling cutter on three axis machines. ESA

N89-12271# Amsterdam Univ. (Netherlands). Dept. of Computer Science.
MAINTAINING RANGE TREES IN SECONDARY MEMORY. PART 1: PARTITIONS
Mark H. Overmars, Michiel H. M. Smid, Mark T. deBerg, and Marc J. vanKreveld (Utrecht State Univ., Netherlands) Nov. 1987 38 p Sponsored in part by the Netherlands Organization for the Advancement of Pure Research
(FVI-87-14; ETN-88-93432) Avail: NTIS HC A03/MF A01

Range tree partition schemes that limit the part sizes and the number of disk accesses necessary to perform updates and queries are presented. It is shown that for each fixed positive integer k, there is a partition of a two-dimensional range tree into parts of size 0 (n sup 1/k) such that each update requires at most k(2k+1) disk accesses, and each query requires at most 4k(2k+1)-4+2t disk accesses, where t is the number of answers to the range query. ESA

N89-12272# Amsterdam Univ. (Netherlands). Dept. of Computer Science.
MAINTAINING RANGE TREES IN SECONDARY MEMORY. PART 2: LOWER BOUNDS
Mark H. Overmars and Michiel H. M. Smid Oct. 1987 24 p Sponsored in part by the Netherlands Organization for the Advancement of Pure Research
(FVI-87-15; ETN-88-93433) Avail: NTIS HC A03/MF A01

Given a partition of a range tree into parts of size at most F(n), such that each update passes through at most G(n) of these parts, the relation between F(n) and G(n) (useful to store and maintain the range tree in secondary memory) is studied. The number of seeks to perform an update is at most G(n), and the total amount of data that has to be transported from secondary memory to main memory, and vice versa, is bounded above by F(n)G(n). Lower bounds for the partitioning of two- and multi-dimensional range trees, are examined: Given F(n) (resp. G(n)), derive lower bounds on G(n) (resp. F(n)). In a restricted partition, a node of the main tree is contained in the same part as its associated structure. All lower bounds for restricted partitions given turn out to be tight. In a general partition, also associated structures are partitioned. ESA

N89-12273*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GENERATION AND REDUCTION OF THE DATA FOR THE ULYSSES GRAVITATIONAL WAVE EXPERIMENT
R. Agresti, P. Bonifazi, L. Iess, and G. B. Trager Dec. 1987 77 p Prepared in cooperation with Consiglio Nazionale delle Ricerche, Frascati (Italy)
(NASA-CR-184578; NAS 1.26:184578; IFSI-87-20; ETN-88-93467)
Avail: NTIS HC A05/MF A01

A procedure for the generation and reduction of the radiometric data known as REGRES is described. The software is implemented on a HP-1000F computer and was tested on REGRES data relative to the Voyager I spacecraft. The REGRES data are a current output of NASA's Orbit Determination Program. The software package was developed in view of the data analysis of the gravitational wave experiment planned for the European spacecraft Ulysses. ESA

N89-12274# Royal Signals and Radar Establishment, Malvern (England).
COUNTING PATHS IN COMPUTER PROGRAMS
B. D. Bramson May 1988 8 p
(RSRE-Memo-4158; BR107056; ETN-88-93555) Copyright
Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

An algebraic method for assessing the numbers of paths through loopfree portions of computer programs is presented, thus providing a useful measure of complexity. The underlying program model is that of a directed graph, though this does not exclude recursion. The algebraic structure is that of a path algebra but with one axiom relaxed. The theory was implemented within the Malvern Program Analysis Suite. Experience shows it to be of particular value in guiding the analysis of large programs. ESA

N89-12275# Royal Aerospace Establishment, Farnborough (England).
MIXTURE REDUCTION ALGORITHMS FOR UNCERTAIN TRACKING
D. J. Salmond Jan. 1988 60 p
(RAE-TR-88004; RAE-AW-28; BR106714; ETN-88-93558)
Copyright Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

Two algorithms for reducing Gaussian mixture distributions are presented. The techniques preserve the mean and covariance of the original mixture, and the final approximation is itself a Gaussian mixture. The reduction is achieved by successively merging components or groups of components. The two algorithms were used to control the growth of components which occurs with the solution to the problem of tracking a single object, in the presence of uniformly distributed false measurements. Simulation results are presented which compare the performance of the resulting tracking filters and the probabilistic data association filter. ESA

N89-12276 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
AN ALGORITHM FOR LEAST SQUARES CIRCLE FITTING TO DATA WITH SPECIFIED UNCERTAINTY ELLIPSES
Maurice G. Cox and Helen M. Jones Jun. 1988 21 p
(NPL-DITC-118/88; ISSN-0262-5369; ETN-88-93569) Copyright
Avail: National Physics Lab., Teddington, Middlesex, TW11 0LW, United Kingdom

The problem of fitting a circle to a set of measured data points specified in terms of their Cartesian coordinates is considered. It is assumed that the data adequately represents a circle and that associated with each data point there is an uncertainty ellipse describing the measurement error. A weighted nonlinear least-squares problem is formulated in order to determine unbiased estimates of the center and radius of the circle which best fits the given data. The resulting problem displays structure which is exploited when the Gauss-Newton algorithm is used to obtain a solution. In addition to estimates of the circle parameters the algorithm produces error ellipses for the center of the circle and any point on its circumference. ESA

N89-12211# Kiel Univ. (West Germany). Praktische Mathematik.
MULTI-GRID METHODS Abstract Only
W. Hackbusch *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 11-12 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 09B

N89-12300# Syracuse Univ., N. Y. Computer and Information Science.
A META-LEVEL EXTENSION OF PROLOG
Kenneth A. Bowen and Tobias Weinberg *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 923-936 (For primary document see N89-12284 03-63)
(Grant AF-AFOSR-0292-82)
(TR-CIS-85-1) Avail: NTIS HC A21/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N89-12277# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE CONCURRENT ENVIRONMENT OF THE SEQUENT BALANCE 8000 M.S. Thesis
Floyd Davenport 1988 140 p
(AD-A196694; AFIT/CI/NR-88-60) Avail: NTIS HC A07/MF A01 CSCL 12E

Concurrent programming is an intense area of research in computer science. There are two types of concurrent programming. Multiprogramming refers to multiple processes executing on a single processor in the same time period by using a method called Time-slicing. Multiprocessing refers to multiple processes which execute at the same time each on its own processor. This paper deals with the issues of multiprocessing. A process is defined as a section of code which is executed sequentially. However, there is a problem with these new multiprocessing systems. The problem centers around the fact that the software industry has failed to keep pace with the multiprocessing enhancements produced by the hardware industry. This paper has two objectives. The first objective is to investigate and document the mechanisms for process creation and control on a commercial multiprocessing system. The Texas A and M Sequent Balance 8000 Multiprocessing System is the target of this objective. The second objective is to add a new mechanism to this existing system that easily and clearly expresses process creation. GRA

N89-12278# University of Southern California, Marina del Rey. Information Sciences Inst.
REDUCING THE VULNERABILITY OF DYNAMIC COMPUTER NETWORKS
Gregory G. Finn Jun. 1988 79 p
(Contract MDA903-87-C-0719)
(AD-A196792; ISI/RR-88-201) Avail: NTIS HC A05/MF A01 CSCL 12G

Networks are becoming important in the day-to-day operations of business, the military, and government. As the use of networks grows, it is a wise precaution to assume that malicious attempts to sabotage a network will occur. Network operating software should not make the network susceptible to widespread failure if one router, or even several, deviate from acceptable behavior. Network software should be resistant to this manner of attack while preserving the desirable network attributes of flexibility and efficiency. This report points out that several commonly used routing procedures imply a vulnerability to attack, and presents a routing procedure that allows the development of operating software that is highly resistant to attack. GRA

N89-12279# Maryland Univ., College Park.
PARALLEL LOGIC PROGRAMMING AND ZOMB Final Report, 30 Jun. 1982 - 13 Feb. 1988
Jack Minker and Mark Weiser 26 Apr. 1988 12 p
(Grant AF-AFOSR-0303-82; AF Proj. 2304)
(AD-A196942; AFOSR-88-0562TR) Avail: NTIS HC A03/MF A01 CSCL 12E

This final report presents a summary of research accomplished to investigate parallel problem solving. Under the current grant a parallel problem solving system, PRISM (Parallel Inference System), that was implemented on the VAX/11-780, the PYRAMID and SUN machines, was ported successfully to McMOB and then to the BBN Butterfly parallel architecture. The McMOB architecture is essentially the ZMOB architecture with 16 Motorola 68000 processors, upgrading the Z80A microprocessors, interconnected in a ring structure. Experimental testing of PRISM on McMOB was undertaken in the current year. In addition, several enhancements were made to PRISM to permit experimental analyses to be made, and to incorporate additional features to take full advantage of parallelism in a problem solving environment. The tracing and statistical gathering packages were extended. An ability to display AND-parallelism was added to the trace program which displays the execution of a program on the parallel machines. In addition to the above, work continued in the area of informative answers to be presented to a user. Heuristic techniques were developed to determine which information to display. GRA

N89-12280# Naval Postgraduate School, Monterey, Calif.
DISTRIBUTED COMPUTER COMMUNICATIONS IN SUPPORT OF REAL-TIME VISUAL SIMULATIONS M.S. Thesis
Theodore H. Barrow Jun. 1988 178 p
(AD-A197595) Avail: NTIS HC A09/MF A01 CSCL 12G

Complex visual simulations can strain the capability of a single workstation. A mix of different workstations is often more economical than the use of a large processor for such simulations. Methods of communicating between such workstations are needed that allow the developer to spend effort on the simulation and not on communications. Simple protocols are developed to support both broadcast and direct-connect communications between workstations using TCP/IP on an Ethernet. Comparisons are made between broadcast and direct connect protocols. GRA

N89-12281# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
DATA COMMUNICATION NETWORK AT NLR FOR SUPERCOMPUTER USAGE
F. J. vandenBosch and U. Postuma deBoer 2 Oct. 1987 62 p
In DUTCH; ENGLISH summary
(NLR-TR-87132-U; B8817906; ETN-88-93386) Avail: NTIS HC A04/MF A01

Aerospace research and development computer facilities are presented, including a NEC SX-2 supercomputer, a Control Data Cyber 180-855 mainframe, and various minicomputers and workstations. To provide users with good access to the various systems, a high speed computer network, consisting of a communication network for terminal data transfer and one for file transfer in lock is defined. ESA

N89-12282*# Johns Hopkins Univ., Baltimore, Md. Dept. of Computer Science.
FAULT DIAGNOSIS IN SPARSE MULTIPROCESSOR SYSTEMS Semiannual Progress Report
Douglas M. Blough, Gregory F. Sullivan, and Gerald M. Masson 29 Nov. 1988 17 p
(Grant NsG-1442)
(NASA-CR-183396; NAS 1.26:183396) Avail: NTIS HC A03/MF A01 CSCL 09B

The problem of fault diagnosis in multiprocessor systems is considered under a uniformly probabilistic model in which processors are faulty with probability p. This work focuses on minimizing the number of tests that must be conducted in order to correctly diagnose the state of every processor in the system with high probability. A diagnosis algorithm that can correctly diagnose the state of every processor with probability approaching one in a class of systems performing slightly greater than a linear number of tests is presented. A nearly matching lower bound on the number of tests required to achieve correct diagnosis in arbitrary systems is also proven. The number of tests required under this probabilistic model is shown to be significantly less than under a bounded-size fault set model. Because the number of tests that must be conducted is a measure of the diagnosis overhead, these results represent a dramatic improvement in the performance of system-level diagnosis technique. Author

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N89-12283*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PARAMETRIC LQ APPROACH TO MULTIOBJECTIVE CONTROL SYSTEM DESIGN
Douglas E. Kyr and Marc Buchner (Case Western Reserve Univ., Cleveland, Ohio.) 1988 13 p Proposed for presentation at the 27th Conference on Decision and Control, Austin, Tex., 7-9 Dec. 1988; sponsored by IEEE
(Grant NAG3-659)
(NASA-TM-101316; E-4312; NAS 1.15:101316) Avail: NTIS HC A03/MF A01 CSCL 09B

The synthesis of a constant parameter output feedback control law of constrained structure is set in a multiple objective linear quadratic regulator (MOLQR) framework. The use of intuitive objective functions such as model-following ability and closed-loop trajectory sensitivity, allow multiple objective decision making techniques, such as the surrogate worth tradeoff method, to be applied. For the continuous-time deterministic problem with an infinite time horizon, dynamic compensators as well as static output feedback controllers can be synthesized using a descent Anderson-Moore algorithm modified to impose linear equality constraints on the feedback gains by moving in feasible directions. Results of three different examples are presented, including a unique reformulation of the sensitivity reduction problem. Author

N89-12284# Syracuse Univ., N. Y.
NORTHEAST ARTIFICIAL INTELLIGENCE CONSORTIUM (NAIC). REVIEW OF TECHNICAL TASKS, VOLUME 2, PART 2 Interim Report, Dec. 1984 - Dec. 1985
J. F. Allen, P. B. Berra, J. A. Biles, K. A. Bowen, S. E. Conry, W. B. Croft, V. R. Lesser, R. A. Meyer, J. W. Modestino, and G. Nagy et al. Jul. 1987 494 p Consortium held in Syracuse, N.Y.; sponsored by RADC Sponsored in part by the Laboratory Director's Fund
(Contract F30602-85-C-0008; AF Proj. 2304)
(AD-A189774; RADC-TR-86-218-Vol-2-Pt-2) Avail: NTIS HC A21/MF A01 CSCL 09B

The purpose of NAIC is to conduct pertinent research in artificial intelligence and to perform activities ancillary to this research. Progress is described that has been made in the first year of the existence of the NAIC on the technical research tasks undertaken at the member universities. The topics covered are: versatile expert system for equipment maintenance, distributed AI for communication system control, automatic photointerpretation, time oriented problem solving, speech understanding systems, knowledge base maintenance, hardware architectures for very large systems, knowledge based reasoning and planning, and a knowledge acquisition, assistance, and explanation system. For individual titles, see N89-12285 through N89-12300.

N89-12285# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Electrical, Computer and Systems Engineering.
AUTOMATIC PHOTO INTERPRETATION
J. W. Modestino and G. Nagy *In* Syracuse Univ., N.Y. Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 467-483 (For primary document see N89-12284 03-63)
Avail: NTIS HC A21/MF A01 CSCL 09B

The objectives of this project was to develop a system to assist a photointerpreter to understand, interpret, and report the contents of a digitized photograph more rapidly and more consistently, and to reduce the degree of personnel expertise necessary. A summary is presented of a transform based invariant feature extraction method for objects in digital images. A summary is also presented of the development of a simple inference engine for image interpretation. An outline is given of the work currently underway, at the time of this document. Author

N89-12286# Rensselaer Polytechnic Inst., Troy, N.Y.
DESIGN OF AN INFERENCE ENGINE FOR AN IMAGE INTERPRETATION EXPERT SYSTEM
P. S. Bhaskar *In* Syracuse Univ., N.Y. Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 485-596 Previously announced as X86-74375 (For primary document see N89-12284 03-63)
(IPL-TR-067) Avail: NTIS HC A21/MF A01 CSCL 09B

The development is described of an inference engine for an image interpretation expert system. The inference engine has the capability to prove or disprove hypotheses by chaining backwards through a sequence of rules or to arrive at a conclusion from a set of observed facts. Three methods for estimating the validity of the conclusion drawn from inexact data and uncertain rules are described. The design of the inference engine was specifically directed toward possible use in an image interpretation expert system. Author

N89-12287# Princeton Univ., N. J.
TRANSFORMATION INVARIANT ATTRIBUTES FOR DIGITIZED OBJECT OUTLINES
B. G. Nickerson *In* Syracuse Univ., N.Y. Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 597-699 (For primary document see N89-12284 03-63)
(IPL-TR-068) Avail: NTIS HC A21/MF A01 CSCL 09B

Techniques were developed for classifying objects in aerial and satellite imagery. Recognition of objects is based on their boundary (shape) only. Two distinct approaches were investigated, one based on Fourier descriptors and one based on invariant moments. A set of programs which compute and analyze these scale-, translation-, and rotation-invariant attributes of object outlines is described. The Fourier descriptor and invariant moments were applied to test data representing 21 digitized aircraft outlines to give a list of invariant attributes for each aircraft. A fuzzy clustering analysis of these invariant attributes was made to see if aircraft of similar shape clustered together based on the invariant attribute data. Two irregular blob shapes were analyzed to see the effect of random and systematic noise on their invariant attributes. It is shown that the area, perimeter, invariant moments and Fourier descriptors are useful in uniquely describing individual object shapes. Author

N89-12288# Rit Research Corp., Rochester, N.Y.
SPEECH UNDERSTANDING RESEARCH
Harvey Rhody *In* Syracuse Univ., N.Y. Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 701-714 (For primary document see N89-12284 03-63)
Avail: NTIS HC A21/MF A01 CSCL 09B

Methods were developed for a large vocabulary, speaker independent continuous time speech understanding system. A signal processing model of the auditory system was produced. It was shown that speech processing algorithms based on this model are capable of resolving speech parameters in both time and frequency domains with greater accuracy than was heretofore possible. Author

N89-12289# Rochester Univ., N. Y. Dept. of Computer Science.
TIME-ORIENTED PROBLEM SOLVING
James F. Allen *In* Syracuse Univ., N.Y. Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 715-717 (For primary document see N89-12284 03-63)
Avail: NTIS HC A21/MF A01 CSCL 09B

Progress has been made in research on time oriented problem solving in several areas. A new theory of time was developed based on temporal intervals that is considerably simpler and more elegant than the previous theory, and which subsumes and extends the latter. Also considerable progress was made on the development of a formal model for problem solving in temporally rich, uncertain worlds based on the combination of the temporal logic and existing logics of counterfactuals. It was also shown how plan recognition in simple worlds (e.g., the blocks world) can be formally related to and derived from a theory of planning in those worlds, thereby relating planning and plan recognition in an intuitively satisfying way. Finally, the conversion of the HORNE system (the general inference engine upon which the planning and plan recognition systems are built) into Common Lisp on the Symbolics machines from Franz Lisp on a VAX is close. Author

N89-12290# Rochester Univ., N. Y. Dept. of Computer Science.
A COMMON-SENSE THEORY OF TIME
James F. Allen and Patrick J. Hayes *In* Syracuse Univ., N.Y. Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 719-729 (For primary document see N89-12284 03-63)
Avail: NTIS HC A21/MF A01 CSCL 09B

The literature on the nature and representation of time is full of disputes and contradictory theories. This is surprising since the nature of time does not cause any worry for people in their everyday coping with the world. What this suggests is that there is some form of common sense knowledge about time that is rich enough to enable people to deal with the world, and which is universal enough to enable cooperation and communication between people. Such a theory is proposed and defended in two ways. A theory of time is axiomatized in terms of intervals and the single relation MEET. It is then shown that this axiomatization subsumes Allen's interval-based theory. The theory is then extended by formally defining the beginnings and endings of intervals and show that these have the properties one would normally associate with points. These point-like objects and the concept of moment as hypothesized in discrete time models are distinguished between. Finally, the theory of time is examined in terms of each of several different models. Author

N89-12291# Rochester Univ., N. Y. Dept. of Computer Science.
A MODEL OF NAIVE TEMPORAL REASONING
James F. Allen and Henry A. Kautz *In* Syracuse Univ., N.Y. Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 731-747 (For primary document see N89-12284 03-63)
Avail: NTIS HC A21/MF A01 CSCL 09B

Temporal reasoning is an essential part of most tasks considered as intelligent behavior. In fact, it is so prevalent that it is often not recognized explicitly. Naive temporal reasoning as it is required within two areas are considered: natural language comprehension and problem solving. A theory of time is outlined that accounts for many problem solving situations, examples of which are given, and which appears to be computationally effective.

Basic issues on the nature of temporal representations are discussed, and an interval-based approach rather than a point-based approach (i.e., in which time is viewed as analogous to the real line) is argued. A brief description is then provided of a temporal reasoner built and it is demonstrated by some examples involving story comprehension. Finally, it is described how the model may be applied to problem solving. Author

N89-12292# Rochester Univ., N. Y. Dept. of Computer Science.

TOWARD A THEORY OF PLAN RECOGNITION

Henry A. Kautz *In* Syracuse Univ., N.Y. Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 749-815 (For primary document see N89-12284 03-63)
(Contract N00014-82-K-0193; NSF RCD-84-50125)
(TR162) Avail: NTIS HC A21/MF A01 CSCL 09B

The problem of recognizing an agent's plans arises in many contexts in work in artificial intelligence. The plan recognition techniques suggested in the literature are rarely formally justified. Plan recognition, herein, is viewed as a special kind of non-monotonic reasoning, and it is demonstrated how formal techniques developed for reasoning, namely, circumspection and minimal entailment, can be used in plan recognition. A broad range of work in artificial intelligence and philosophy which relates to plan recognition is reviewed. A formal treatment of a simple case of plan recognition follows, and the report is concluded with proposals for future extensions of the work. Author

N89-12293# Rochester Univ., N. Y. Dept. of Computer Science.

A FORMAL LOGIC THAT SUPPORTS PLANNING WITH A PARTIAL DESCRIPTION OF THE FUTURE

Richard N. Pelavin *In* Syracuse Univ., N.Y. Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 817-833 (For primary document see N89-12284 03-63)
Avail: NTIS HC A21/MF A01 CSCL 09B

A formal logic is presented that can be used to reason about planning to achieve's one goals. A robust temporal logic (Allen's interval logic) is extended with a counterfactual-like modality, called IFTRIED, that can be used to describe what can and cannot be done by the planning agent, the robot. This allows the representation of planning problems where the robot has a partial description of the past, present, and expected future, and its goal is to bring about a set of desired future conditions. It is shown how the IFTRIED modality can be used to represent knowledge about what can and cannot be done. Briefly discussed is how the logic can be used to reason about the interaction of two concurrent actions and some conditions under which two actions can be executed together are specified. Author

N89-12294# Syracuse Univ., N. Y. Electrical and Computer Engineering.

COMPUTER ARCHITECTURES FOR VERY LARGE KNOWLEDGE BASES c60

P. Bruce Berra *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 835-851 (For primary document see N89-12284 03-63)
Avail: NTIS HC A21/MF A01 CSCL 09B

The current state of the art in knowledge based expert systems is such that the intensional database (IDB) of rules and the extensional database of facts (EDB) are small and main memory resident. The goal of this reseach is to develop innovative computer architectures that efficiently manage very large knowledge bases in a real time environment. There are many ways to represent knowledge in an expert system. A logic programming framework was chosen because of its strong mathematical foundation, its commonality with relational data base management, prior and current Prolog and MetaProlog work and the potential for making significant improvements in the performance of logic programs through the exploitation of search parallelism. A description is provided of the partial match retrieval problem that results when one seeks to retrieve facts from EDB. The approach to the improvement of the performance of the partial match retrieval problem is then discussed along with an initial computer architecture. Author

N89-12295# Syracuse Univ., N. Y. Logic Programming Research Group.

KNOWLEDGE BASE MAINTENANCE USING LOGIC PROGRAMMING METHODOLOGIES

Kenneth A. Bowen *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 853-858 (For primary document see N89-12284 03-63)
Avail: NTIS HC A21/MF A01 CSCL 09B

The development of extensions of the logic programming language Prolog which are suitable for application to the problem of maintaining consistency and logical structure for large dynamic knowledge bases is discussed. The logical representation of the assertions of a knowledge base is to identify them with the facts and rules of the logic programming language. So-called metalevel extensions of Prolog are being developed. The metalevel extensions have the character that logical concepts which are implicit in Prolog systems are made explicit in the extension. In particular, theories, which are only implicit in Prolog, become explicit first-clase objects capable of being the values of variables and of being dynamically constructed and modified in a logical manner. While the immediate motivation for the reification of theories was the representation of change in knowledge bases, a pleasant side-effect is the ability to clearly implement a number of classical artificial intelligence knowledge representation schemes such as frames and semantic nets. A similar approach is being taken to the problem of control. Author

N89-12296# Syracuse Univ., N. Y. Logic Programming Research Group.

META-LEVEL PROGRAMMING AND KNOWLEDGE REPRESENTATION

Kenneth A. Bowen *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 859-891 (For primary document see N89-12284 03-63)
(Contract F30602-81-C-0169; AF-AFOSR-0292-82)
Avail: NTIS HC A21/MF A01 CSCL 09B

The nature of metalevel extension of Prolog is outlined. The key features include the treatment of theories (databases) and metalevel names as first-class objects which may be the values of variables. The use of the power of these constructs in traditional knowledge representation is explored. In particular, it is shown how frames, semantic nets, scripts, message passing, and non-standard control can be represented. Author

N89-12297# Syracuse Univ., N. Y. Logic Programming Research Group.

FAST DECOMPILATION OF COMPILED PROLOG CLAUSES

Kevin A. Buettner *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 893-900 (For primary document see N89-12284 03-63)
Avail: NTIS HC A21/MF A01 CSCL 09B

The methods described have applications beyond implementation of clause, retract, and listing. The method of setting breakpoints may be used to implement debuggers (in particular, the standard four-port debugger). Breakpoints are set on the next call, execute or proceed instruction and the next failure address (obtained from the top choice point). When the breakpoint is executed, the appropriate call, redo, fail, or exit message is printed. Redo and fail messages are printed when the failure breakpoint was reached. One or more exit messages are printed when a breakpoint corresponding to a proceed instruction is executed. Call messages are printed on call and execute instructions. Because of the generalized tail recursion optimizations in the Warren architecture, it is necessary to maintain debug frames. These frames contain such information as the previous debug frame, the parent debug frame, the call structure and whether the instruction that caused this frame to be created was an execute or a call. These frames may be safely kept on the heap; in fact keeping the frames on the heap permits a clever implementation of deciding how many redo messages to print when a failure occurs. Author

N89-12298# Syracuse Univ., N. Y. Logic Programming Research Group.

THE DESIGN AND IMPLEMENTATION OF A HIGH-SPEED INCREMENTAL PORTABLE PROLOG COMPILER c60

Kenneth A. Bowen, Kevin A. Buettner, Ilyas Cicekli, and Andrew Turk *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 901-921 (For primary document see N89-12284 03-63)
(Contract F30602-81-C-0159; AF-AFOSR-0292-82)
Avail: NTIS HC A21/MF A01 CSCL 09B

The design and implementation of a relatively portable Prolog compiler achieving 12K LIPS on the standard benchmark is described. The compiler is incremental and uses decompilation to implement retract, clause, and listing, as well as support the needs of its four-port debugger. The system supports modules, garbage collection, database pointers, and a full range of built-ins. Author

N89-12299# Syracuse Univ., N. Y. Logic Programming Research Group.

COMPILER OPTIMIZATIONS FOR THE WAM c60

Andrew K. Turk *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 915-921 (For primary document see N89-12284 03-63)
(Contract F30602-81-C-0169)
Avail: NTIS HC A21/MF A01 CSCL 09B

A series of Warren Abstract Machine (WAM) implementation techniques are presented. These techniques and compilation strategies are designed for use in a highly optimized native code Prolog compiler. A thorough knowledge of the WAM and Prolog compilation is assumed. Author

N89-12300# Syracuse Univ., N. Y. Computer and Information Science.

A META-LEVEL EXTENSION OF PROLOG c61

Kenneth A. Bowen and Tobias Weinberg *In its* Northeast Artificial Intelligence Consortium (NAIC). Review of Technical Tasks, Volume 2, Part 2 Jul. 1987 p 923-936 (For primary document see N89-12284 03-63)
(Grant AF-AFOSR-0292-82)
(TR-CIS-85-1) Avail: NTIS HC A21/MF A01 CSCL 09B

A system called metaProlog is examined, which narrowly conceived, is an extension of Prolog. The real power of this system lies not in the specific system facilities described, but in the programming methodology introduced. The example given only begins to explore the possibilities of this system. Using this approach, frames and default hierarchies are logically characterized, networks of theories and semantic nets are generalized, and more general control strategies such as bottom-up or breadth-first searched. There is no logical requirement that the only notion of proof in metaProlog be the Horn clause-oriented demo predicate introduced. Other methods of proof should be able to coexist with demo. The situation is envisioned in which another method of proof would be rapidly prototyped using explicit recursive calls on the present demo, and later integrated into the system at a low level using the same bootstrapping methods adopted for the implementation of the basic metaProlog system. Author

N89-12301# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THE PROBLEM OF PLANNING IN A VISUAL NAVIGATION SYSTEM

C. A. MarquesNogueira and Valter Rodrigues Jul. 1988 10 p In PORTUGUESE; ENGLISH summary Presented at the 7th Brazilian Congress of Automatics, San Jose dos Campos, Brazil, 15-19 Aug. 1988
(INPE-4617-PRE/1340) Avail: NTIS HC A02/MF A01

The representation of the knowledge about the environment necessary to the automatic planning of paths is an important problem in mobile robot applications. A hierarchical representation of this knowledge is presented. This representation enables the exploration of visibility factors which result in a reduction of the final planned path. There is a planning system working on this representation that realizes generation and execution monitoring of the plan simultaneously. The representation which is used enables the learning about the environment and the obstacles that are found during task execution. Author

N89-12302# Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.

NEUROCON-1: PROCEEDINGS

W. B. Dress, ed. May 1988 41 p Conference held in San Jose, Calif., 27 Jul. 1986; sponsored by NOVIX, Inc.
(Contract DE-AC05-84OR-21400)
(DE88-013108; CONF-8607100) Avail: NTIS HC A03/MF A01

Five presentations dealing with state of the art research in computerized simulation of neural networks are presented. These contributions are indexed and abstracted separately. DOE

N89-12303# Lawrence Livermore National Lab., Calif.

DECENTRALIZED ADAPTIVE CONTROL OF LARGE SCALE SYSTEMS, WITH APPLICATION TO ROBOTICS Ph.D. Thesis

Donald T. Gravel, Jr. Mar. 1988 117 p
(Contract W-7405-eng-48)
(DE88-015409; UCRL-53866) Avail: NTIS HC A06/MF A01

Present day economic, technological, and environmental systems are large and complex. Gaining an understanding of large scale systems, that is, modeling their behavior and designing appropriate stabilizing controls, is a foremost challenge of modern system theory. One approach to large scale system modeling and control is decomposition of the large system into smaller, more manageable units. This is known as the decentralized approach. Decentralized control schemes have proven to be robust to a large range of uncertainties and nonlinearities in interconnections and subsystem dynamics. For the purpose of decentralized control, decompositions of large scale systems are typically formulated to isolate uncertainty about system behavior to the interaction between subsystems. Thereby the subsystems themselves are well modeled and decentralized controllers can be designed according to standard techniques. In this thesis, the theory of decentralized adaptive control for decentrally stabilizable systems has been developed. The new schemes depend upon local high gain feedback to stabilize local systems sufficiently to overcome interconnection disturbances. DOE

N89-12304# Argonne National Lab., Ill. Mathematics and Computer Science Div.

COMPUTATIONAL DYNAMIC PROGRAMMING FOR STOCHASTIC OPTIMAL CONTROL ON A VECTOR MULTIPROCESSOR

Floyd B. Hanson Jun. 1988 28 p Presented at the 3rd SIAM Conference on Parallel Processing for Scientific Computing, Los Angeles, Calif., 1 Dec. 1987
(Contract W-31-109-eng-38)
(DE88-016469; ANL/MCS-TM-113; CONF-871251-7) Avail: NTIS HC A03/MF A01

Numerical methods have been developed to solve optimal feedback control problems for nonlinear, continuous time dynamical systems, perturbed by Poisson as well as Gaussian random white noise. Predictor-corrector methods have been modified for the functional partial differential equation of stochastic dynamic programming to treat nonlinearities attributable to quadratic costs and nonsmoothness attributable to control switching as well as Poisson-induced delays. Uniform corrector convergence conditions are given for the multistate case. This numerical formulation is highly suitable for vectorization and parallelization techniques. These techniques have resulted in speedups of 120 times for the Argonne National Laboratory's Alliant FX/8 vector multiprocessor over a VAX 11/780, when applied to a multistate, multicontrol resource model. Speedups are greater the finer the mesh becomes, because of the dominance of concurrent-outer, vector-inner loops. Column-oriented code can run more than twice as fast as row-oriented code for highly refined meshes, but row-oriented code is more efficient and perhaps practical for coarser meshes. An analytical model of the primary loop structure yields a concurrent-outer, vector-inner loop dominant limit. DOE

N89-12305# Ecole Centrale de Lyon (France). Lab. d'Electrotechnique.
THE CONTROL STABILITY OF HYDROELECTRIC NETWORKS BY CONTROLS. AN ADAPTIVE MODAL REGULATION MODEL Ph.D. Thesis [LA STABILITE DES RESEAUX HYDRO-ELECTRIQUES PAR LES REGLAGES. PRESENTATION D'UNE METHODE DE REGULATION MODALE ADAPTATIVE]
Marc Langevin 1987 156 p In FRENCH
(ECL-87-25; ETN-88-93256) Avail: NTIS HC A08/MF A01

A linear modeling program covering generation control stability is described and validated, and an adaptive modal regulation method for multimachine systems, based on minimization of total energy consumed by the system to regain equilibrium is presented. A computer program used to calculate the regulation parameters is detailed. The resulting controls are robust and very stable. The responses are perhaps too robust for networks like Hydro-Quebec. Softening the command reaction is to be studied. ESA

N89-12306# Institut National Polytechnique, Grenoble (France).
GEOMETRIC REASONING AND DECISION MAKING IN ROBOTICS. APPLICATION TO AUTOMATIC ROBOT PROGRAMMING Ph.D. Thesis [RAISONNEMENT GEOMETRIQUE ET METHODES DE DECISION EN ROBOTIQUE. APPLICATION A LA PROGRAMMATION AUTOMATIQUE DES ROBOTS]
Christian Laugier 1987 279 p In FRENCH; ENGLISH summary
(ETN-88-93264) Avail: NTIS HC A13/MF A01

The computer tools which are necessary for the effective programming of assembly robots are studied. The method to develop these tools using computer aided design facilities is shown. The facilities include graphic simulation, graphic programming, geometric programming, and interactive learning. Modeling and reasoning techniques developed for implementing planning functions are described, including geometric modeling, spatial and morphological reasoning, and reasoning about uncertainties. The techniques are combined to obtain an automatic robot programming system named SHARP. ESA

N89-12307# Institut National Polytechnique, Grenoble (France).
HANDEY: A PLANNING MODEL FOR THE AUTOMATIC PROGRAMMING OF ROBOTS Ph.D. Thesis [HANDEY: UN MODELE DE PLANIFICATEUR POUR LA PROGRAMMATION AUTOMATIQUE DES ROBOTS]
Emmanuel Francois Mazer 1987 155 p In FRENCH; ENGLISH summary
(ETN-88-93265) Avail: NTIS HC A08/MF A01

A system designed to plan a pick-and-place operation with a robot manipulator is described. The system automatically plans the necessary operations to perform the assembly: part recognition, grasping, path planning, and regrasping. The control structure is based on a hierarchy of tests. The algorithms used by the planner are presented with a simple geometric formalism. The experimentation and the potential of the system are discussed. ESA

N89-12308# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
CONTRIBUTION TO THE STUDY OF ADAPTIVE DECENTRALIZED CONTROL OF INTERCONNECTED SYSTEMS Ph.D. Thesis - Toulouse Univ.
Ahmed Benhammou 1988 239 p In FRENCH; ENGLISH summary
(LAAS-88-181; ETN-88-93287) Avail: NTIS HC A11/MF A01

The analysis and synthesis of an adaptive command system for linear systems formed by a set of interconnected subsets are studied. The parameters of the model describing the dynamic behavior of the model are supposed unknown. A command law, with a decentralized structure, is created in such a way that a given performance could be accomplished in spite of the parameter incertitude. The theory and the simulations presented show that such an adaptive decentralized command is possible, and that it may have properties assuring stability and convergence. ESA

N89-12309*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPERT SYSTEM FOR RESTRUCTURABLE CONTROL
Jonathan Litt 1988 9 p Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, Ohio
(NASA-TM-101378; E-4433; NAS 1.15:101378; AVSCOM-TR-88-C-023) Avail: NTIS HC A02/MF A01 CSCL 09B

Work in progress on an expert system which restructures and tunes control systems on-line is presented. The expert system coordinates the different methods for redesigning and implementing the control strategies due to system changes. The research is directed toward aircraft and jet engine applications. The implementation is written in LISP and is currently running on a special purpose LISP machine. Author

N89-12310# Technische Hogeschool, Delft (Netherlands). Faculty of Mathematics and Informatics/Computer Science.
HEURISTIC REASONING
Nico Roos 1988 21 p
(Rept-88-31; B8823225; ISSN-0920-8577; ETN-88-93367) Copyright Avail: NTIS HC A03/MF A01

A model for heuristic reasoning with uncertain knowledge is presented. The model is a generalization of the approach proposed by Clancey (1984, 1985). A clear semantics for the model, showing that the heuristic reasoning process can be given a clear probabilistic interpretation, is proposed. ESA

N89-12311# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
ALMOST DISTURBANCE DECOUPLING FOR SINGLE-INPUT SINGLE-OUTPUT NONLINEAR SYSTEMS
R. Marino (Rome Univ., Italy), W. Respondek, and A. J. vanderSchaft May 1988 17 p Revised
(Memo-714; B8821274; ISSN-0921-1969; Memo-647; ETN-88-93436) Avail: NTIS HC A03/MF A01

The almost disturbance decoupling problem for nonlinear single-input single-output systems is addressed by using singular perturbation methods and high-gain feedback. Sufficient conditions and the explicit high-gain nonlinear state feedback in solvable cases are given. They generalize almost results for linear systems and exact ones for nonlinear systems. The necessity of the conditions is discussed. An example where the main structural condition is not satisfied and the high-gain control designed on the basis of linear approximations fails to achieve almost disturbance decoupling for the original system is given. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N89-12312*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
CFD CODE EVALUATION Semiannual Report, Apr. - Sep. 1988
T. J. Chung, Y. M. Kim, and R. Hallit Oct. 1988 20 p
(Grant NAG8-095)
(NASA-CR-182661; NAS 1.26:182661) Avail: NTIS HC A03/MF A01 CSCL 12A

The task carried out under this research grant covers research on accuracy and efficiency of computational fluid dynamic (CFD) stategies, error estimates for convective terms, and antidiffusion.

These basic studies are considered important in evaluating available CFD codes which will be the main activities for the next year. Author

N89-12313# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst. Nizkikh Temperatur.
APPLICATIONS OF CONTINUAL INTEGRALS TO SOLUTION SOME INVERSE PROBLEMS FOR THREE-DIMENSIONAL SCHROEDINGER EQUATION
G. N. Gestrin 1986 35 p In RUSSIAN
(DE88-702883; INIS-SU-47) Avail: NTIS (US Sales Only) HC A03/MF A01

Nonlinear integral equations of the second kind for the known inverse problems of the spectral theory of Schroedinger operator H=-Delta+v(r-vector) are deduced from the solution of the initial value problem presented in the form of the continual Wilner integral. New theorems and formulae connecting the spectral kernel of the family of operators with the potential v(r-vector) are given. DOE

N89-12314 Council for National Academic Awards (England).
A GENERALIZED APPROACH FOR TRANSFORMING DOMAIN INTEGRALS INTO BOUNDARY INTEGRALS IN BOUNDARY ELEMENT METHODS Ph.D. Thesis
Weifeng Tang 1988 208 p
Avail: Univ. Microfilms Order No. BRDX80698

A general approach to transform domain integral terms into boundary integral terms in Boundary Element Method (BEM) formulations is presented. The technique can be used for both potential and elasticity problems. The method is based on expanding the integrands in domain integrals into Fourier series, which ensures convergence of results. The corresponding Fourier coefficients can be calculated analytically or numerically. The mathematical implementation and corresponding programming are described in this thesis. Numerical applications using the present approach validate and illustrate how the method can be used in engineering practice, including the application for elasto-plastic analysis. The present approach is a general and reliable transformation technique. Dissert. Abstr.

N89-12315*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FUNDAMENTALS OF LINEAR ESTIMATION, REVISION A Final Report
Charles L. Lawson 28 Sep. 1987 40 p
(Contract NAS7-918)
(NASA-CR-183237; NAS 1.26:183237; JPL-D-4305-Rev-A; JPL-TM-17) Avail: NTIS HC A03/MF A01 CSCL 12A

This document tracks a selection of topics in linear estimation, beginning with a very simple situation and progressing through more complications. Topics in estimation, properties of random distribution, and least squares are discussed. GRA

N89-12316*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THREE-DIMENSIONAL MULTIGRID ALGORITHMS FOR THE FLUX-SPLIT EULER EQUATIONS
W. Kyle Anderson, James L. Thomas, and David L. Whitfield (Mississippi State Univ., Mississippi State.) Nov. 1988 41 p
(NASA-TP-2829; L-16416; NAS 1.60:2829) Avail: NTIS HC A03/MF A01 CSCL 12A

The Full Approximation Scheme (FAS) multigrid method is applied to several implicit flux-split algorithms for solving the three-dimensional Euler equations in a body fitted coordinate system. Each of the splitting algorithms uses a variation of approximate factorization and is implemented in a finite volume formulation. The algorithms are all vectorizable with little or no scalar computation required. The flux vectors are split into upwind components using both the splittings of Steger-Warming and Van Leer. The stability and smoothing rate of each of the schemes are examined using a Fourier analysis of the complete system of equations. Results are presented for three-dimensional subsonic, transonic, and supersonic flows which demonstrate substantially improved convergence rates with the multigrid algorithm. The influence of using both a V-cycle and a W-cycle on the convergence is examined. Author

N89-12317# International Centre for Theoretical Physics, Trieste (Italy).
OPERATIONS INVOLVING MOMENTUM VARIABLES IN NON-HAMILTONIAN EVOLUTION EQUATIONS
F. Benatti, G. C. Ghirardi, A. Rimini, and T. Weber (Trieste Univ., Italy) Feb. 1988 37 p
(DE88-703166; IC-88/45) Avail: NTIS (US Sales Only) HC A03/MF A01

Non-Hamiltonian evolution equations have been recently considered for the description of various physical processes. Among this type of equations the class which has been more extensively studied is the one usually referred to as Quantum Dynamical Semigroup equations (QDS). In particular an equation of the QDS type has been considered as the basis for a model, called Quantum Mechanics with Spontaneous Localization (QMSL), which has been shown to exhibit some very interesting features allowing to overcome most of the conceptual difficulties of standard quantum theory. QMSL assumes a modification of the pure Schroedinger evolution by assuming the occurrence, at random times, of stochastic processes for the wave function corresponding formally to approximate position measurements. In this paper, we investigate the consequences of modifying and/or enlarging the class of the considered stochastic processes, by considering the spontaneous occurrence of approximate momentum and of simultaneous position and momentum measurements. It is shown that the considered changes in the elementary processes have unacceptable consequences. In particular, they lead either to drastic modifications in the dynamics of microsystems or are completely useless from the point of view of the conceptual advantages that one was trying to get from QMSL. The present work supports therefore the idea that QMSL, as originally formulated, can be taken as the basic scheme for the generalizations which are still necessary in order to make it appropriate for the description of systems of identical particles and to meet relativistic requirements. DOE

N89-12318# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE APPLICATION OF THE HIERARCHICAL ADAPTIVE REFINEMENT, IN P-VERSION, ON THE RESOLUTION, THROUGH THE FINITE ELEMENT METHOD FOR PROBLEMS OF BIDIMENSIONAL ELASTICITY THEORY M.S. Thesis - Instituto Technologico de Aeronautica
Jarbas Antonio Guedes Aug. 1988 132 p In PORTUGUESE; ENGLISH summary
(INPE-4649-RPE/572) Avail: NTIS HC A07/MF A01

The hierarchical adaptative refinement technique of the finite element method, in p-version, applied to bidimensional elasticity theory is presented. Usual techniques to obtain error indicators and estimators are discussed and an alternative manner to deal with error indicators is presented. Author

N89-12319# Army Armament Research and Development Command, Watervliet, N. Y. Weapons Lab.
FUNCTION SMOOTHING BY REPEATED AVERAGING Final Report
Royce Soanes Mar. 1988 58 p
(AD-A196575; ARCCB-TR-88012) Avail: NTIS HC A04/MF A01 CSCL 12C

General formulas for smooth univariate shape preserving approximation and allied accuracy preserving approximation are derived. Shape preserving properties of the smoothing operators are discussed, equivalent kernel forms are obtained, and thorough error analyses (with and without noise) are conducted for the smoothing operators and their derivatives. The class of functions to be approximated is the piecewise polynomials of possibly low smoothness. GRA

N89-12320# Center for Naval Analyses, Alexandria, Va. Strike and Amphibious Warfare Research Dept.
BAYESIAN ESTIMATION OF n IN A BINOMIAL DISTRIBUTION Final Report
Victor K. Tang, Ronald B. Sindler, and Raymond M. Shirven Oct. 1987 30 p
(Contract N00014-87-C-0001; Proj. R01-48)
(AD-A196623; CRM-87-185) Avail: NTIS HC A03/MF A01 CSCL 12C

Let X Sub 1,X Sub 2,...,X, be a random sample of size r from a binomial distribution b(n, p). Let x Sub 1,x Sub 2,...,x Sub r, be r-observed success counts. A method has been developed to estimate the total number of trials n from a Bayesian perspective when the probability of success p is either known or unknown. The prior distribution for n is assumed to be the discrete uniform distribution. In the case when p is unknown, p is assumed to have a beta prior distribution. The estimate for n is then the mode of the posterior distribution. Additionally, guidelines for selecting shape parameters for the beta distributions are discussed. GRA

N89-12321# Purdue Univ., West Lafayette, Ind. Center for Statistical Decision Sciences.
HIERARCHICAL BAYESIAN SELECTION PROCEDURES FOR THE BEST BINOMIAL POPULATION
John J. Deely and Shanti S. Gupta May 1988 25 p
(Contract N00014-88-K-0170; NSF DMS-86-06964)
(AD-A196651; TR-88-21C) Avail: NTIS HC A03/MF A01 CSCL 12C

In this paper a hierarchical Bayesian model is adopted to derive selection procedures for selecting the best of k binomial parameters, say the probability of success corresponding to k different suppliers. This model facilitates the use of prior information in the analysis for both small and large sample sizes. In addition to computing posterior probabilities that the i to the th power supplier is best, this paper presents expressions for deciding how much better a given supplier is relative to the others. Prior information is assumed to begin with exchangeability and can be more informative if the experimenter has other knowledge about the suppliers as a group. A numerical example is given and the paper concludes with remarks about future work. GRA

N89-12322# San Diego State Univ., Calif. Center for Research in Mathematics and Science Education.
SCHEMA KNOWLEDGE FOR SOLVING ARITHMETIC STORY PROBLEMS: SOME AFFECTIVE COMPONENTS Technical Report, 1 Sep. 1986 - 1 Sep. 1987
Sandra P. Marshall May 1988 17 p
(Contract N00014-85-K-0661; Proj. RR0-4206)
(AD-A197016; CRMSE-88-01) Avail: NTIS HC A03/MF A01 CSCL 05H

This report discusses the role of affect in cognitive processing. The importance of affect in process mathematical information is described in the context of solving arithmetic story problems. More specifically, the author offers some ideas about the way affective responses to mathematical problem-solving situations influence the development, maintenance, and retrieval of information stored in human memory. He outlines a model of human memory based upon schema knowledge structures and suggests how affective information may be stored within a schema. The report concludes with a discussion of some affective responses to mathematics evidenced by students' comments as they worked with story problems. The topic is introduced with descriptions of two affective responses to solving arithmetic story problems. GRA

N89-12323# Maryland Univ., College Park. Inst. for Physical Science and Technology.
ADVANCES IN THE p AND h-p VERSIONS OF THE FINITE ELEMENT METHOD: A SURVEY
I. Babuska 1988 13 p
(Contract N00014-85-K-0169; NSF DMS-84-10324)
(AD-A197498; AD-E501007) Avail: NTIS HC A03/MF A01 CSCL 12A

A survey is made of the advances in the theory and practice of the p and h-p versions of the finite element method. It gives the extensive list of references related to recent results of this new approach. The finite element method has become the main tool in computational mechanics. The MAKABASE contains at present the information on approximately 1400 finite/boundary element programs, about 20,000 references on finite element and 2,000 boundary element technology. To date there are more than two hundred monographs and proceedings. Recently a new direction in the finite element theory and practice appeared, the p and h-p versions which utilizes high degree elements. Some 3 to 4 dozen references (out of 22,000) and only few programs are available. The aim of the paper is to briefly survey the state of the art about the p and h-p versions and present the basic references. We restrict ourself to the most simple but a characteristic model problem for elliptic partial differential equations. GRA

N89-12324# Naval Surface Weapons Center, Silver Spring, Md.
AN ACTIVE FILTER PRIMER, MOD 2 Final Report
Arthur D. Delagrange 1 Sep. 1987 148 p
(AD-A197538; NSWC-TR-87-174) Avail: NTIS HC A07/MF A01 CSCL 09A

In the past few years active filters have become very popular. This report explains their popularity as well as what active filters can (and cannot) do. It gives the basics of active filter design, both in theory and practice. It can be used as a handbook to build working active filters of the most common types. This report is an update of one issued in 1982. GRA

N89-12325# Florida Univ., Gainesville. Dept. of Statistics.
MULTIRESPONSE ROTATABILITY Technical Report No. 302
Andre I. Khuri Jun. 1988 19 p
(Contract N00014-86-K-0059)
(AD-A197575) Avail: NTIS HC A03/MF A01 CSCL 12C

Since its introduction by Box and Hunter, rotatability of a response surface design has always been associated with single-response models. This article extends this design concept to multiresponse models. For these models, rotatability means constant prediction variances and covariances, and hence correlations, among the predicted responses at points that are equidistant from the design center. It is shown that multiresponse rotatability can be achieved if and only if the design is rotatable (in the usual sense) for a single-response model whose order, or degree, is the highest among all the response models under consideration. This property does not depend on the form of the variance-covariance matrix of the responses. GRA

N89-12326# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
LINEAR TRANSFORMATIONS, PROJECTION OPERATORS AND GENERALIZED INVERSES: A GEOMETRIC APPROACH
C. R. Rao Mar. 1988 22 p
(Grant AF-AFOSR-0030-88; AF Proj. 2304)
(AD-A197608; TR-88-04; AFOSR-88-0758TR) Avail: NTIS HC A03/MF A01 CSCL 12B

A generalized inverse of a linear transformation A: v yield w, where v and w are finite dimensional vector spaces, is defined using geometric concepts of linear transformations and projection operators. The inverse is uniquely defined in terms of specified subspaces m is a subset of v, 1 is a subset of w and a linear transformation N such that AN = O, NA = O. Such an inverse which is unique is called the 1mN-inverse. A Moore-Penrose type inverse is obtained by putting N=O. Applications to optimization problems when v and w are inner product spaces, such as least squares in a general setting, are discussed. The results given in the paper can be extended without any major modification of proofs to bounded linear operators with closed range on Hilbert spaces. GRA

N89-12327# Army Armament Research, Development and Engineering Center, Watervliet, N.Y. Weapons Lab.
A POSTERIORI ERROR ESTIMATION OF ADAPTIVE FINITE DIFFERENCE SCHEMES FOR HYPERBOLIC SYSTEMS Final Report
David C. Arney, Rupak Biswas, and Joseph E. Flaherty Jun. 1988 38 p
(AD-A197665; ARCCB-TR-88024) Avail: NTIS HC A03/MF A01 CSCL 12A

Several techniques are described based on Richardson's extrapolation for estimating discretization errors of finite difference solutions of one- and two-dimensional hyperbolic systems. These a posteriori error estimates are intended for use with adaptive mesh moving and local refinement procedures. Mesh moving algorithms produce nonuniform grids which necessitate special treatment of solution and error estimation techniques. The required adjustments are discussed using a two-step MacCormack method as a model finite difference scheme. Also discussed are automatic time step selection procedures and the effects of artificial viscosity. Extrapolation schemes that produce separate estimates of the temporal and spatial discretization errors are presented and we show how these may be used to control local mesh refinement procedures. Several examples illustrating these procedures are presented. GRA

N89-12328# Ecole Centrale de Lyon (France). Lab. d'Electrotechnique.
NEW APPLICATIONS OF THE BOUNDARY INTEGRAL EQUATIONS METHOD TO ELECTRICAL ENGINEERING Ph.D. Thesis [APPLICATIONS NOUVELLES DE LA METHODE DES EQUATIONS INTEGRALES DE FRONTIERE EN ELECTRONTECHNIQUE]
Qi Sheng Huang 1987 107 p In FRENCH; ENGLISH summary
(ETN-88-93254) Avail: NTIS HC A06/MF A01

Surface conduction under alternating stress and magnetic induction in dynamic state are simulated. The modeling of the problems and the boundary conditions are discussed. The computer programs prepared for both cases are detailed. The simulation results prove the efficiency of the programs described. ESA

N89-12329# Grenoble-1 Univ. (France).
AXIOMATIZATION OF AGGREGATION PREFERENCE PROCEDURES Ph.D. Thesis [AXIOMATISATION DE PROCEDURES D'AGREGATION DE PREFERENCES]
Bernard Debord 1987 142 p In FRENCH; ENGLISH summary
(ETN-88-93267) Avail: NTIS HC A07/MF A01

An axiomatic study of procedures and multiprocedures concerning two sets of binary relations on X, a finite set of alternatives, is presented. The aim is mapping from the finite data subsets to the model set or its nonempty subsets. The axiomatic characterization of procedures relying on preference matrices only, and the characterization of those matrices for different sets of data are presented. The notion of choice function is extended and discussed. Prudent procedures and sequential variations of Borda's procedure are examined. ESA

N89-12330# Grenoble-1 Univ. (France). Techniques de l'Informatique, des Mathematiques, de la Microelectronique et de la Microscopie Quanti
FUNDAMENTAL OPERATIONS IN WEYL ALGEBRA [OPERATIONS FONDAMENTALES DANS L'ALGEBRE DE WEYL]
Guoting Chen May 1988 24 p In FRENCH; ENGLISH summary
(RR-722-M; ETN-88-93271) Avail: NTIS HC A03/MF A01

The fundamental operations in the Weyl algebra A2(K) are discussed, as well as the calculation of the GCD and PCM (left hand and right hand) of differential polynomials in the same algebra, and the computation of primitive polynomials and the determinant of the matrices whose coefficients are described in algebra A2(K). ESA

N89-12331# Grenoble-1 Univ. (France). Techniques de l'Informatique, des Mathematiques, de la Microelectronique et de la Microscopie Quanti
ABOUT THE CONTROL OF NUMERICAL ERRORS [AUTOUR DU CONTROLE DE L'ERREUR NUMERIQUE]
Phillipe Francois Jun. 1988 37 p In FRENCH; ENGLISH summary
(RR-729-M; ETN-88-93276) Avail: NTIS HC A03/MF A01

A normative point of view is adopted, studying the origin of the numerical error and exploring answers linked with arithmetic and program conception. A unified model of numerical computation (near to Miller computational tree model) is used to explore the main control methods in floating arithmetic. Perturbation methods are discussed in particular. The Vignes perturbation method applied to matrix inversions by the Gauss method shows that the Gaussian approach is empirically feasible. ESA

N89-12332# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Sciences.
SYMMETRIC (AND GENERIC) ALGORITHMS FOR HEIGHT BALANCED TREES
Coen Bron 1987 17 p
(CS-8711; ETN-88-93356) Avail: NTIS HC A03/MF A01

An algorithm for AVL trees in which symmetry is fully exploited, and therefore the left and right algorithms can be mapped onto each other, is presented. The interface with the application is fully generic, i.e., the algorithm is fit for application in any environment, regardless of the kind of data being stored in the tree. A way of discussing binary trees without the need to introduce a pictorial representation is illustrated. ESA

N89-12333# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.
ON THE RELATIONSHIP BETWEEN THE SUBSET AND SIGMA TYPES IN MARTIN-LOF'S 79 TYPE THEORY
Paul Chisholm 1988 19 p
(CS-8802; ETN-88-93358) Avail: NTIS HC A03/MF A01

Conditions under which an object of type set (A, B), can be translated to an object of type Sigma (A, B) i.e., given a derivation of a is a member of set (A, B), the conditions under which the proof object for B(a) can be recovered are found. It is shown that although the subset type is a considerable convenience for discarding redundant proof objects (which alone justifies its inclusion in the theory), it does not effectively add to the power of the theory, nor can it be used to reduce the burden of proof. The situation is very different when congruence types are admitted to the theory. The subset type can be used in conjunction with congruence types to significantly reduce the amount of work necessary to prove propositions. The construction of a derivation of set (A, B) from a derivation of sigma (A, B) is easily shown within the theory. ESA

N89-12334# Groningen Rijksuniversiteit (Netherlands). Dept. of Mathematics and Computing Science.
ON ROTA'S THEORY OF POLYNOMINALS OF BINOMIAL TYPE
A. DiBucchianico 1988 17 p
(TW-280; ETN-88-93363) Avail: NTIS HC A03/MF A01

Solution methods for convolution equations are discussed, and it is shown that operators can be used with polynomials. This yields simpler proofs than using power series. A special class of sequences of convolution type is described in terms of operators. Sheffer sets are considered. ESA

N89-12335# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
MULTIGRID METHODS IN BOUNDARY ELEMENT CALCULATIONS
H. Schippers 16 Apr. 1987 22 p Presented at the 9th International Conference on Boundary Element Methods in Engineering, Stuttgart, Fed. Republic of Germany, 31 Aug.-4 Sep. 1987

(NLR-MP-87025-U; B8807287; ETN-88-93393) Avail: NTIS HC A03/MF A01

Multigrid iterative methods are advocated for the fast solution of algebraic systems occurring in boundary element calculations. Multigrid methods combine relaxation schemes for reducing high-frequency errors and coarse grid corrections for diminishing low-frequency errors. The choice of the relaxation scheme is found to be essential to attain a fast convergent iterative process. Asymptotically, the multigrid method needs only two iterations to obtain a result of the order of the truncation error. The fast convergence, however, may break down if the relaxation scheme does not account for boundary singularities such as corners and edges. This is illustrated for the calculation of potential flow around an airfoil. ESA

N89-12336*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

NONCONFORMING MORTAR ELEMENT METHODS: APPLICATION TO SPECTRAL DISCRETIZATIONS Final Report

Yvon Maday, Cathy Mavriplis, and Anthony Patera (Massachusetts Inst. of Tech., Cambridge.) Oct. 1988 29 p Submitted for publication

(Contracts NAS1-18107; NAS1-18605)

(NASA-CR-181729; ICASE-88-59; NAS 1.26:181729) Avail: NTIS HC A03/MF A01 CSCL 12A

Spectral element methods are p-type weighted residual techniques for partial differential equations that combine the generality of finite element methods with the accuracy of spectral methods. Presented here is a new nonconforming discretization which greatly improves the flexibility of the spectral element approach as regards automatic mesh generation and non-propagating local mesh refinement. The method is based on the introduction of an auxiliary mortar trace space, and constitutes a new approach to discretization-driven domain decomposition characterized by a clean decoupling of the local, structure-preserving residual evaluations and the transmission of boundary and continuity conditions. The flexibility of the mortar method is illustrated by several nonconforming adaptive Navier-Stokes calculations in complex geometry. Author

N89-12337*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ON THE ACCURACY OF SOLVING TRIANGULAR SYSTEMS IN PARALLEL

Nai-kuan Tsao (Wayne State Univ., Detroit, Mich.) Nov. 1988 27 p

(NASA Order C-99066-G)

(NASA-TM-101384; E-4439; ICOMP-88-19; NAS 1.15:101384) Avail: NTIS HC A03/MF A01 CSCL 12A

An error complexity analysis of two algorithms for solving a unit-diagonal triangular system is given. The results show that the unusual sequential algorithm is optimal in terms of having the minimal maximum and cumulative error complexity measures. The parallel algorithm described by Sameh and Brent is shown to be essentially equivalent to the optimal sequential one. Some numerical experiments are also taught. Author

N89-12338# Technische Hochschule, Darmstadt (West Germany). Fachbereich Mathematik.

COMPUTATION OF TIME-MINIMAL DISTRIBUTED CONTROLS OF VIBRATING SYSTEMS DESCRIBED BY THE FINITE ELEMENT METHOD Ph.D. Thesis [ZUR BERECHNUNG ZEITMINIMALER VERTEILTER STEUERUNGEN VON SCHWINGENDEN SYSTEMEN UNTER VERWENDUNG DER FINITE ELEMENT METHODE]

Ulrich Lamp 1987 97 p In GERMAN

(ETN-88-93241) Avail: NTIS HC A05/MF A01

A method for the approximate computation of time-minimal control is described. Time and norm-minimal properties are compared, and approximation of eigenvalues and eigenfunctions for the resolution of the Cauchy problems is performed by Galerkin procedure. The finite element method is applied using Bell and Argyris elements. Lanczos algorithm is programmed and simple inverse iteration and simultaneous vectorization are treated. ESA

N89-12339# Technische Hogeschool, Delft (Netherlands). Faculty of Mathematics and Informatics/Computer Science.

PHASE PORTRAITS FOR QUADRATIC SYSTEMS WITH A HIGHER ORDER SINGULARITY. PART 2: A SECOND ORDER POINT WITH TWO ZERO EIGENVALUES

P. deJager 1988 30 p

(Rept-88-32-Pt-2; B8823226-Pt-2; ISSN-0920-8577; ETN-88-93368) Copyright Avail: NTIS HC A03/MF A01

Phase portraits of quadratic systems of differential equations in the plane are considered. The possible phase portraits for quadratic systems with a second order singular point, having two zero eigenvalues (cusp point) are given. ESA

N89-12340# Technische Hogeschool, Delft (Netherlands). Faculty of Mathematics and Informatics/Computer Science.

REGULARITY OF THE FREE BOUNDARY IN A DOUBLY DEGENERATE PARABOLIC EQUATION

M. Bertsch, C. J. vanDuijn, J. R. Esteban (Universidad Autonoma de Madrid, Cantoblanco, Spain), and Zhang Hongfrei 1988 30 p

(Rept-88-38; B8823232; ISSN-0920-8577; ETN-88-93374) Copyright Avail: NTIS HC A03/MF A01

An initial value problem of the type which arises in hydrology for the study of the interface between two fluids with different specific weight, is treated. ESA

N89-12341# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.

INSTANTANEOUS SHRINKING IN NONLINEAR DIFFUSION-CONVECTION

B. H. Gilding (Humphreys Corp., Concord, N.H.) and R. Kersner Jun. 1988 16 p Sponsored in part by the Hungarian Academy of Sciences Research Fund, Budapest, Hungary

(Memo-715; B8821275; ISSN-0921-1969; ETN-88-93437) Avail: NTIS HC A03/MF A01

The Cauchy problem for a nonlinear diffusion-convection equation is studied. The equation may be classified as being of degenerate parabolic type with one spatial derivative and a time derivative. It is shown that under certain conditions, solutions of the initial value problem exhibit instantaneous shrinking. This is to say, at any positive time the spatial support of the solution is bounded above, although the support of the initial data function is not. This is a phenomenon which is normally only associated with nonlinear diffusion with strong absorption. It is shown that for a certain class of initial data functions there is a critical positive time such that the support of the solution is unbounded above at any earlier time, while the opposite is the case at any later time. ESA

N89-12342# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.

ON LEMKE'S METHOD

C. G. Broyden Jun. 1988 35 p

(Memo-716; B8821276; ISSN-0921-1969; ETN-88-93438) Avail: NTIS HC A03/MF A01

Let M be an nth order matrix and q and d be vectors, both of order n, and let v be a scalar variable. Then the linear complementarity problem, (LCP) (q + Vd,M) is defined to be: Determine a vector x is less than or = 0 such that w = Mx + q + vd is less than or = 0 and x sup T w = 0. It is shown that if M is nondegenerate, every solution of LCP (q + Vd,M) for all values of v lies on a graph where the solutions corresponding to nodes are degenerate and those corresponding to arcs are nondegenerate. Nodes are associated with particular values while arcs are associated with open intervals of v. Arcs emanating from a given node are shown to be determined by the solutions of two smaller LCPs involving Schur complements of M, and this enables inductive proofs to be constructed for standard results, establishing relationships between the number of solutions for two different values of v and, in the case where M is a P-matrix, uniqueness of the solutions. It is suggested that this technique may be extended to divide the q-space into a number of cells in an attempt to isolate solutions of LCP(q,M). ESA

N89-12210# Umea Univ. (Sweden). Inst. of Information Processing.
ANALYTICAL AND NUMERICAL SOLUTIONS TO HIGHER INDEX LINEAR VARIABLE COEFFICIENT DAE SYSTEMS Abstract Only
Anders Barrlund and Bo Kagstroem *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 6-7 (For primary document see N89-12209 03-59)
(UMINF-134.87; ISSN-0348-0542) Avail: NTIS HC A08/MF A01 CSCL 12A

N89-12213# Jyvaskyla Univ. (Finland). Dept. of Mathematics.
ON STATE CONSTRAINED CONTROL PROBLEMS
Raino Makinen *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 25-29 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

N89-12214# Muenster Univ. (West Germany).
NUMERICAL METHOD IN COMPUTERIZED TOMOGRAPHY
F. Natterer *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 30-32 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

N89-12216# Saarland Univ., Saarbrucken (West Germany). Fachbereich Mathematik.
EXTRAPOLATION TECHNIQUES IN THE FINITE ELEMENT METHOD: A SURVEY
Rolf Rannacher *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 80-113 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

N89-12217# Jyvaskyla Univ. (Finland).
ON OPTIMAL MESH DESIGN FOR FEM IN CONTACT PROBLEMS
Kimmo Salmenjoki *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 114-124 Sponsored by the Academy of Finland (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

N89-12218# Chalmers Univ. of Technology, Goeteborg (Sweden).
STREAMLINE DIFFUSION FINITE ELEMENT METHODS FOR HYPERBOLIC CONSERVATION LAWS
Anders Szepessy and Peter Hansbo *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 125-133 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

N89-12219# Geneva Univ. (Switzerland).
STIFF DIFFERENTIAL EQUATIONS, STUDY OF ONE-STEP METHODS
G. Wanner *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 134-145 (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

N89-12220# Chalmers Univ. of Technology, Goeteborg (Sweden).
SEMIDISCRETE L-SPLINE FINITE ELEMENT SCHEMES WITH HIGH SUPERCONVERGENCE AT THE NODES FOR PARABOLIC EQUATIONS IN ONE SPACE VARIABLE
Nai-Ying Zhang and Yishao Zhou (Royal Inst. of Tech., Stockholm, Sweden) *In* Helsinki Univ. of Technology, Proceedings of the Summer School in Numerical Analysis at Helsinki 1987 Feb. 1988 p 146-157 Prepared in cooperation with Goeteborg Univ., Sweden (For primary document see N89-12209 03-59)
Avail: NTIS HC A08/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N89-12343# American Coll. Testing Program, Iowa city, Iowa.
THE EFFECT OF ITEM PARAMETER ESTIMATION ERROR ON DECISIONS MADE USING THE SEQUENTIAL PROBABILITY RATIO TEST
Judith A. Spray and Mark D. Reckase Oct. 1987 33 p
(Contract N00014-85-C-0241; Proj. RR0-4204)
(AD-A196674; ACT-RR-SER-87-17-ONR; RR-ONR-87-1) Avail: NTIS HC A03/MF A01 CSCL 12C

A series of computer simulations were performed in order to observe the effects of item response theory (IRT) item parameter estimation error on decisions made using an IRT-based sequential probability ratio test. Specifically, the effects of such error on misclassification rates and the average number of items required for either a mastery (pass) or nonmastery (fail) decision were observed under varied SPRT conditions. These conditions include the a priori or nominal type I (alpha) and type II (beta) error rates, the simple hypotheses tested by the SPRT procedure, and the composition of the item pool (specifically the a, b, and c parameters which characterized the items according to a three-parameter logistic model) used to administer the SPRT. The results of these simulations showed that these SPRT decisions are not greatly affected by this particular level of error in parameter estimates modeled in this study. Misclassification error rates were slightly greater when estimation error in the item parameters was present, but such differences appear to be negligible. GRA

N89-12344# Scripps Institution of Oceanography, La Jolla, Calif. Marine Physical Lab.
BROADBAND SPECTRAL ESTIMATION USING THE MULTIPLE WINDOW METHOD: A COMPARISON WITH CLASSICAL TECHNIQUES Summary Report
Jean-Marie Tran Jun. 1988 80 p
(Contract N00014-87-C-0127)
(AD-A197630; MPL-TM-403; MPL-U-16/88) Avail: NTIS HC A05/MF A01 CSCL 07D

The Multiple Window recently introduced by D.J. Thomson is an alternative approach to spectral estimation. Using an orthogonal decomposition of the Discrete Fourier Transform of the data on the prolate spheroidal wave sequences, the power spectrum is estimated by a weighted average of raw spectra obtained from the Fourier transforms of the data windowed by the prolate sequences. This method has the reputation of working well on short data sequences, offering good variance control and a fair resolution. Because the Multiple Window technique combines Fourier transforms with data adaptive weighting, it is compared, in a Monte Carlo simulation, to more conventional spectral estimation methods: the classic averaged Fourier transforms technique and Capon's Maximum Likelihood method. The underlying spectral density to be estimated is of an ARMA process simulating underwater acoustic ambient noise. It is characterized by a moderate dynamic range of 30 dB and can be regarded as a generic spectrum of many applications. The three methods considered here are non parametric, so that no estimator has an unfair advantage. The normalized bias, random and root mean square errors, as well as the statistical distributions, based on 512 realizations of the spectral density, quantify the performance of the three different techniques. GRA

N89-12345# Texas A&M Univ., College Station. Dept. of Statistics.
COVARIANCE ANALYSIS IN GENERALIZED LINEAR MEASUREMENT ERROR MODELS Technical Report No. 12, Aug. 1987 - Aug. 1988
Raymond J. Carroll Aug. 1988 36 p
(Contract F49620-85-C-0144)
(AD-A197661; AFOSR-88-0776TR) Avail: NTIS HC A03/MF A01 CSCL 12C

This summarizes some of the recent work on the errors-in-variables problem in generalized linear models. The focus is on covariance analysis, and in particular testing for and estimation of treatment effects. There is a considerable difference between the randomized and nonrandomized models when testing for an effect. For estimation, one is largely reduced to using an errors in variables analysis. Some of the possible methods are outlined and compared. GRA

N89-12346# Technische Hogeschool, Delft (Netherlands). Faculty of Mathematics and Informatics/Computer Science.
UNMASKING MULTIVARIATE OUTLIERS AND LEVERAGE POINTS BY MEANS OF ROBUST COVARIANCE MATRICES
Peter J. Rousseeuw (Fribourg Univ., Switzerland) and Bert C. vanZomeren 1988 23 p
(Rept-88-29; B8823223; ISSN-0920-8577; ETN-88-93365)
Copyright Avail: NTIS HC A03/MF A01

In order to pinpoint outliers in multivariate data sets, it is proposed to insert robust estimates of multivariate location and covariance. The high-breakdown location estimator used is the center of the minimum volume ellipsoid covering at least half of the observations, and the corresponding robust covariance estimator is given by the same ellipsoid. The resulting robust Mahalanobis distances allow labeling of multivariate outliers. In a regression data set, it is possible to identify leverage points by applying this method to the explanatory variables only. A display in which the residuals from a high-breakdown regression are plotted versus the robust distances is proposed. This plot provides an immediate classification of the data into regular observations, vertical outliers, good leverage points, and bad leverage points. ESA

N89-12347# Technische Hogeschool, Delft (Netherlands). Faculty of Mathematics and Informatics/Computer Science.
PSEUDO-ISOTROPIC MEASURES
J. K. Misiewicz and C. L. Scheffer 1988 48 p
(Rept-88-33; B8823227; ISSN-0920-8577; ETN-88-93369)
Copyright Avail: NTIS HC A03/MF A01

A problem connected with probability measures is treated: if mu 1 in a given symmetric probability measure over R, does there exist a symmetric nondegenerate probability measure mu over R sup n such that every one-dimensional projection of mu is equal to mu 1 up to a scale parameter. Canonical representations of the pseudo-isotropic measures are reviewed. The complete characterization of the best known, elliptically contoured measures are included. According to their type of symmetry they are called spherically invariant (Q = I), spherically generated, rotationally invariant, isotropic, etc. Basic trends in the investigations of properties of elliptically contoured measures such as infinite divisibility, geometrical structure, conditional expectations, etc., are considered. An unexpectedly simple and clear canonical representation of the 1-symmetric measures is assessed. ESA

N89-12348# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
ON THE POISSON ARRIVALS SEE TIME AVERAGES (PASTA) PROPERTY AND A FURTHER RELATIONSHIP BETWEEN CUSTOMER AND TIME AVERAGES IN STATIONARY QUEUEING SYSTEMS
D. Koenig, V. Schmidt, and E. A. vanDoorn May 1988 14 p
(Memo-713; B8821273; ISSN-0921-1969; ETN-88-93435) Avail: NTIS HC A03/MF A01

Queueing systems in statistical equilibrium and a property known as PASTA (Poisson Arrivals See Time Averages) are discussed. Examples show that for this property to be valid, as well as for a related property called Conditional PASTA, the independence assumption usually made in this connection is not necessary. A formula of Brumelle (1971) relating the time-average workload to the delay in queue and the service time of a customer to queueing systems with preemptive service discipline is extended. ESA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N89-12349# International Centre for Theoretical Physics, Trieste (Italy).
ON CLOSURE OF THE LIGHT-CONE GAUGE CLOSED SUPERSTRING ALGEBRA
A. Restuccia and J. G. Taylor Dec. 1987 10 p Submitted for publication
(DE88-703003; IC-87/393) Avail: NTIS (US Sales Only) HC A02/MF A01

We construct four-field generators to achieve closure of the 10-dimensional SUSY algebra for the heterotic and type II superstring light cone gauge field theory. Closure for the heterotic case is achieved in a regularization independent manner, whilst that for type II needs the use of constant time and phase integration regularizations. The resulting 4-field Hamiltonians are briefly related to terms arising in the amplitudes for the two theories constructed from the cubic terms alone. DOE

N89-12350# Technische Hogeschool, Delft (Netherlands). Faculty of Mathematics and Informatics/Computer Science.
SPACES WITH VAGUELY UPPER SEMICONTINUOUS INTERSECTION
Wim Vervaat 1988 9 p
(Rept-88-30; B8823224; ISSN-0920-8577; ETN-88-93366)
Copyright Avail: NTIS HC A02/MF A01

Spaces not assumed to be Hausdorff are considered. The intersection operation in the hyperspace of closed sets is shown to be upper semicontinuous with respect to the vague topology iff covers of saturated quasicompact (qcompact) sets by open sets can be imitated by a similar cover by smaller saturated qcompact sets. A sufficient condition for this is that each saturated qcompact set is part of a locally qcompact set. Results are demonstrated on the example of one-point qcompactifications of spaces whose qcompact sets are closed. ESA

N89-12351# Technische Hogeschool, Delft (Netherlands). Faculty of Mathematics and Informatics/Computer Science.
CHERRY FLOWS ON THE TORUS: TOWARDS A CLASSIFICATION
Marco Martens, Welington deMelo, Pedro Mendes, and Sebastien vanStrien 1988 40 p
(Rept-88-35; B8823229; ISSN-0920-8577; ETN-88-93371)
Copyright Avail: NTIS HC A03/MF A01

Smooth vector fields on the torus T sq with a finite number of singularities are considered. The classification within the class of vector fields which are area contracting near all singularities is completed. A large class of analytic vector fields on the torus T sq which have nontrivial recurrence and sinks is given. This result for vector fields follows from a result dealing with monotone circle mappings which is possibly constant on a finite number of intervals. ESA

N89-12352# Technische Hogeschool, Delft (Netherlands). Faculty of Mathematics and Informatics/Computer Science.
A COUNTABLY COMPACT TOPOLOGICAL GROUP H SUCH THAT H x H IS NOT COUNTABLY COMPACT
Klaas Pieter Hart and J. vanMill 1988 15 p
(Rept-88-37; B8823231; ISSN-0920-8577; ETN-88-93379)
Copyright Avail: NTIS HC A03/MF A01

Assuming Martin's axiom for countable posets (MA countable), a countably compact topological group H for which H sq is not countably compact is constructed. ESA

N89-12353# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
ON CORES OF SUBCONVEX GAMES AND PERMUTATIONALLY CONVEX GAMES
Theo Driessen Jun. 1988 13 p
(Memo-717; B8821277; ISSN-0921-1969; ETN-88-93439) Avail: NTIS HC A03/MF A01

The core of cooperative games with side payments is studied. Three related properties of a cooperative game (convexity, subconvexity, and permutational convexity) which are sufficient for the nonemptiness of the core are examined. The existence of the core for subconvex and permutationally convex games is proved by specifying at least one extreme point of the core in terms of a stable marginal worth vector. Here a marginal worth vector is based on the marginal contributions of single players to coalitions of their predecessors with respect to a fixed ordering of the player set. ESA

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N89-12354# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
HYDROSTATIC EQUILIBRIUM OF THREE CONCENTRIC MASSES IN ROTATION
Kioshi Hada Aug. 1988 12 p In PORTUGUESE; ENGLISH summary
(INPE-4632-RPE/571) Avail: NTIS HC A03/MF A01

A system of three concentric homogeneous masses in rotation with angular velocity, omega, may represent a simple model of the earth-ocean-atmosphere system. Their hydrostatic pressures and gravitational potentials are determined. The hydrostatic pressure, P sub 1, and the gravitational potential, U sub 1, depend on R sup 2. The gravitational potential, U sub 4, depends on R sup -1 (R is the radius). The remaining parameters depend on R sup 2 and R sup -1. These pressures and potentials are important in the gravity waves research in the interface earth-ocean-atmosphere. Author

N89-12355# Minnesota Univ., Minneapolis. Inst. for Mathematics and Its Applications.
IDENTIFICATION OF SMALL INHOMOGENEITIES OF EXTREME CONDUCTIVITY BY BOUNDARY MEASUREMENTS: A CONTINUOUS DEPENDENCE RESULT Final Report
Avner Friedman and Michael Vogelius Dec. 1987 31 p
(AD-A196675; IMA-PREPRINT-SER-373) Avail: NTIS HC A03/MF A01 CSCL 20C

Consider an electrostatic problem for a conductor consisting of finitely many small inhomogeneities of extreme conductivity, embedded in a spatially varying reference medium. Firstly we establish an asymptotic formula for the voltage potential in terms of the reference voltage potential, the location of the inhomogeneities and their geometry. Secondly we use this representation formula to prove a Lipschitz continuous dependence estimate for the corresponding inverse problem. This estimate bounds the difference in the location and in the relative size of two sets of inhomogeneities by the difference in the boundary voltage potentials corresponding to a fixed current distribution. GRA

N89-12356# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
STRUCTURAL OPTIMIZATION INCLUDING CENTRIFUGAL AND CORIOLIS EFFECTS Ph.D. Thesis
Howard D. Gans 1988 120 p
(AD-A196873; AFIT/CI/NR-88-19) Avail: NTIS HC A06/MF A01 CSCL 01A

Investigated are the effects of centrifugal and Coriolis forces on the mode shapes and frequencies of a rotating system. The rotational effects have a profound influence on the eigenfrequencies; this is important in optimal structural redesign where the frequencies must be adjusted. The structural matrices for the rotating system were obtained by examining the expression for the total system energy. This provides a differential stiffness matrix that models centrifugal force and provides velocity-dependent Coriolis matrix. By using a high-level programming language (Direct Matrix Abstraction Programming) a modal analysis solution sequence was modified to account for rotational effects in free vibration. Finite element models were then created for a typical compressor blade in a modern jet engine and for a cantilever beam rotating about the vertical axis. The optimal redesign was done by deriving complex nonlinear inverse perturbation equations for the problem involving both magnitude and phase components. The perturbation problem is solved by using nonlinear mathematical programming. Optimal redesign uses an underdetermined system, i.e., the feasible design must not be unique. This allows the application of an objective function, such as minimum structural weight or minimum change from the baseline design. Constraints, such as those on frequency, are applied. Optimal structural changes are obtained that meet the frequency goals to within three percent. GRA

N89-12357# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
REFLECTION OF WAVES IN NONLINEAR INTEGRABLE SYSTEMS
V. K. Melnikov 1987 22 p In RUSSIAN; ENGLISH summary
(DE88-703381; JINR-R-2-87-136) Avail: NTIS (US Sales Only) HC A03/MF A01

Solutions of the boomeron-type are found in two nonlinear integrable systems describing the interaction of a long wave with a short wave packet. These solutions follow from two-soliton solution if certain additional conditions are imposed on their parameters. The results are relevant to some problems of plasma physics, solid state physics, hydrodynamics, etc. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

N89-12358 Southampton Univ. (England).
APPLICATIONS OF ADAPTIVE FILTERS IN ACTIVE NOISE CONTROL Ph.D. Thesis
Paul Darlington 1987 264 p
Avail: Univ. Microfilms Order No. BRD-80992

The active reduction of acoustic noise is achieved by the addition of a cancelling acoustic signal to the unwanted sound. Successful definition of the cancelling signal amounts to a system identification problem. Recent advances in adaptive signal processing have allowed this problem to be tackled using adaptive filters, which offer significant advantages over conventional solutions. The extension of adaptive noise cancelling techniques, which were developed in the electrical signal conditioning context, to the control of acoustic systems is studied. An analysis is presented of the behavior of the Widrow-Hoff LMS adaptive noise canceller with a linear filter in its control loop. The active control of plane waves propagating axially in a hardwalled duct is used

as a motivating model problem. The model problem also motivates the study of the effects of feedback around an LMS adaptive filter. An alternative stochastic gradient algorithm for controlling adaptive filters in the presence of feedback is presented.
Dissert. Abstr.

N89-12359# SACLANT ASW Research Center, La Spezia (Italy).
PASSIVE LOCALIZATION: A MODEL-BASE APPROACH
J. V. Candy and E. J. Sullivan May 1988 43 p
(AD-A196547; SACLANTCEN-SR-138) Avail: NTIS HC A03/MF A01 CSCL 17A

Passive localization by use of acoustic propagation models, sometimes called Matched Field Processing is usually carried out in three steps. First some appropriate model is selected, then model parameters (usually taken from archival data or from auxiliary measurements) are introduced into the model. Finally acoustic measurements of the field radiated by the source to be located are made - which, in combination with the properly parametrized model, allow a solution for the source coordinates to be carried out. Here we use such a model-based approach in conjunction with a normal-mode model. By coupling the procedure with a parameter estimation/identification scheme and using a horizontal (towed) array instead of the usual vertical array, we show that the model parameters need not be known a priori in order to carry out the solution. This is in contrast to the standard approach in which the modal functions and wavenumber must be a priori known in order to solve the problem; sufficient information to determine the range of the source can be inferred directly from the measured data themselves. Using a sophisticated acoustic propagation model to generate simulated data, coupled with various array signal processing techniques, the feasibility of the approach is demonstrated. GRA

N89-12360# Texas Univ., Austin. Applied Research Lab.
NONLINEAR ACOUSTICS: REFLECTION AND REFRACTION, SCATTERING OF SOUND BY SOUND, AND PERIODIC MEDIA Annual Summary Report, No. 4
David T. Blackstock 1 Jul. 1988 22 p
(Contract N00014-84-K-0574)
(AD-A197614; ARL-TR-88-30) Avail: NTIS HC A03/MF A01 CSCL 20A

Research on three topics in nonlinear acoustics is described: (1) reflection and refraction at a plane interface between two fluids. Previously a modified form of Snell's law was derived; theoretical work is underway to investigate assumptions on which the derivation was based, (2) scattering of sound by sound. Work on a single beam experiment and a crossed-beams experiment is in progress, and (3) propagation in periodic media. An experiment is being designed to measure finite-amplitude distortion in a plane wave tube loaded periodically with reactive branch elements. Other work, on noncollinear interaction and on biomedical ultrasonics, is described briefly. Two journal articles, five oral papers, and one technical report are listed. GRA

N89-12361# Applied Research Lab., State College, Pa.
DISCRETE-FREQUENCY RADIATED NOISE AND UNSTEADY ROTOR FORCE FROM A SUBSONIC AXIAL FLOW FAN M.S. Thesis
Wen-Shyang Chiu, G. C. Lauchle, and D. E. Thompson Jul. 1988 99 p
(AD-A197646; ARL/PSU/TR-88-009) Avail: NTIS HC A05/MF A01 CSCL 20A

Noise radiated by a subsonic, axial-flow fan at its rotational frequency and harmonics is related to the non-steady force field created at the rotor blade/fluid interface. This unsteady field is highly dependent on the time-invariant flow distortions that enter the fan. In this study, a typical cooling fan used in the electronic industry was instrumented with a shaft unsteady axial force sensor. Its output is proportional to the total unsteady axial force created by the rotor. On-axis sound pressure levels were measured and compared to coherent output power spectra involving the unsteady force sensor and the microphone. Very good coherence at the discrete tones is observed. The fan's inflow field was systematically distorted by placing a small cylinder at various positions in the inlet plane. The non-uniform, 3-D flow field entering the rotor was measured by traversing a set of miniature five-hole pressure probes. The total pressure outputs from this probe can be related to the axial, tangential, and radial velocity vectors. Fourier decomposition of the inflow velocity data is coupled with analysis to give information on the unsteady rotor force harmonic content. A simplified Curle's equation was then used to compute the discrete-frequency radiated noise at the Blade Passage Frequency (BPF) and its harmonics. The predicted and measured noise levels are in close agreement at the BPF and the first harmonic when the fan is a compact source. GRA

N89-12362# Naval Underwater Systems Center, New London, Conn.
WAVEVECTOR-FREQUENCY ANALYSIS WITH APPLICATIONS TO ACOUSTICS Interim Report, Oct. 1984 - Sep. 1987
Wayne A. Strawderman 13 Jun. 1988 247 p
(AD-A197676; NUSC-TD-8209) Avail: NTIS HC A11/MF A01 CSCL 20A

The first chapter is introductory, and includes a brief history of the subject. Chapter 2 defines and interprets the parameters that describe harmonic waves, and illustrates how an arbitrary wave field is described in terms of these parameters. The third chapter introduces linear systems and their classifications. The fourth chapter describes the wavevector-frequency characteristics of space-varying, but time-invariant, linear systems, and the fifth chapter treats those characteristics of coupled linear systems. This monograph presents an approach to the description and analysis of acoustic fields and systems that parallels the approach developed in signal processing and linear systems theories to describe and analyze electrical and communications signals and systems. Wavevector-frequency analysis is simply the description of a space-time field or system in terms of the Fourier conjugates of the independent spatial and temporal variables of the field or system. The wavevector is the Fourier conjugate of the spatial vector variable and the frequency is the conjugate of the time variable. The primary advantage of expressing the acoustic field in terms of wavevector and frequency, rather than space and time, is that the Fourier transformation often simplifies the mathematical description of the field or acoustic system, thereby facilitating mathematical analysis and physical interpretation.
GRA

N89-12363# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
THE ACOUSTICS OF A LINED DUCT WITH FLOW
S. W. Rienstra 5 Jan. 1987 72 p
(Contract NIVR-01605N)
(NLR-TR-87002-U; B8817851; ETN-88-93378) Avail: NTIS HC A04/MF A01

A theory to calculate the sound propagation (including attenuation, reflection, radiation) through a three-sectioned cylindrical flow duct, modeling an aero-engine inlet is described. The flow is uniform apart from a thin boundary layer; two of the three sections are hard-walled, with an impedance-walled section in between. The modal amplitudes of the sound field in the duct are determined by an iterative technique allowing the modal expansions to include as many terms as required. The modal eigenvalues are found using a classification based on a distinction between acoustic modes and surface waves. Numerically, the main results are contour plots of constant attenuation, in the complex impedance plane. A dramatic effect of lining (via the occurrence of surface waves) on a sound field that is cut-off in a hard-walled duct is observed. The problems with a lining of constant impedance, and with a (necessarily variable) nonreflective impedance are considered. This problem is mainly relevant to an (acoustic) wind tunnel. It is shown that, for a given free field of the source, the solution describing this impedance distribution can be given analytically in closed form. ESA

N89-12364# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
A SPECTRAL METHOD FOR THE COMPUTATION OF PROPELLER ACOUSTICS
J. B. H. M. Schulten 30 Oct. 1987 15 p Presented at the AIAA 11th Aeroacoustics Conference, Sunnyvale, Calif., 19-21 Oct. 1987
(Contract NIVR-03504N)
(NLR-MP-87038-U; B8815925; ETN-88-93396) Avail: NTIS HC A03/ A01

An analytical description of the acoustic field of a propeller in a uniform flow is derived. Instead of applying the usual Ffowcs Williams-Hawkings version of the acoustic analogy, sources are formulated on a surface enclosing the propeller and its adjacent nonlinear flow field. This approach, which avoids the laborious evaluation of quadrupole source terms, is to be considered as a generalization of the Kirchhoff-Helmholtz theorem of acoustics. By describing the fundamental solution as a spectral Fourier-Bessel decomposition, the resulting sound field is readily given the appropriate series of harmonic amplitudes. The method is validated by a comparison of numerical results with experimental data of a propeller in an acoustic wind tunnel. A good agreement in amplitude and phase is found between theory and experiment. ESA

N89-12365# Southampton Univ. (England). Inst. of Sound and Vibration Research.
A HIGH INTENSITY ACOUSTIC SOURCE FOR ACTIVE ATTENUATION OF EXHAUST NOISE
A. G. Glendinning, S. J. Elliott, and P. A. Nelson Apr. 1988 99 p Sponsored by the Directorate of Marine Technology, London, England
(ISVR-TR-156; ETN-88-93547) Avail: NTIS HC A05/MF A01

An electropneumatic sound source was developed for active noise control systems applied in hostile environments such as the exhaust systems of gas turbines and internal combustion engines. It employs a gas bearing to support the friction free motion of a sliding plate which is used to modulate the supply of compressed air. The sliding plate is driven by an electrodynamic vibrator. Experimental results demonstrate that this arrangement reduces harmonic distortion to at least 20 dB below the fundamental driving frequency for most operating conditions. A theoretical analysis of the transducer enables predictions to be made of the acoustic volume velocity (source strength) produced by the transducer as a function of the upstream pressure and displacement of the sliding valve. Applicability of the transducer to gas turbine and internal combustion engine exhaust systems was tested, and net power consumption resulting from the operation of the device was estimated. ESA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N89-12366*# Fermi National Accelerator Lab., Batavia, Ill.
AXIONS AND SN1987A
Adam Burrows, Michael S. Turner, and R. P. Brinkmann (Ruhr Univ., Bochum, West Germany) Sep. 1988 26 p Sponsored in part by NASA, DOE, Alfred P. Sloan Fellowships and German National Scholarship
(Grant NSF AST-87-14176)
(NASA-CR-183368; NAS 1.26:183368; FERMILAB-Pub-88/105-A) Avail: NTIS HC A03/MF A01 CSCL 20H

The effect of free-streaming axion emission on numerical models for the cooling of the newly born neutron star associated with SN1987A is considered. It is found that for an axion mass of greater than approximately 10 to the -3 eV, axion emission shortens the duration of the expected neutrino burst so significantly that it would be inconsistent with the neutrino observations made by the Kamiokande II and Irvine-Michigan-Brookhaven detectors. However, the possibility has not been investigated that axion trapping (which should occur for masses greater than or equal to 0.02 eV) sufficiently reduces axion emission so that axion masses greater than approximately 2 eV would be consistent with the neutrino observations. Author

N89-12367*# Fermi National Accelerator Lab., Batavia, Ill.
COSMOLOGICAL STRUCTURE FORMATION FROM SOFT TOPOLOGICAL DEFECTS
Christopher T. Hill, David N. Schramm, and J. N. Fry (Florida Univ., Gainesville.) 21 Sep. 1988 17 p Sponsored in part by NASA, DOE, NSF and Chicago Univ., Ill.
(NASA-CR-183371; NAS 1.26:183371; FERMILAB-Pub-88/120-A) Avail: NTIS HC A03/MF A01 CSCL 20H

Some models have extremely low-mass pseudo-Goldstone bosons that can lead to vacuum phase transitions at late times, after the decoupling of the microwave background.. This can generate structure formation at redshifts z greater than or approx 10 on mass scales as large as M approx 10 to the 18th solar masses. Such low energy transitions can lead to large but phenomenologically acceptable density inhomogeneities in soft topological defects (e.g., domain walls) with minimal variations in the microwave anisotropy, as small as delta Y/T less than or approx 10 to the minus 6 power. This mechanism is independent of the existence of hot, cold, or baryonic dark matter. It is a novel alternative to both cosmic string and to inflationary quantum fluctuations as the origin of structure in the Universe. Author

N89-12368# Arcon Corp., Waltham, Mass.
ELECTRON AND PHOTON TRANSPORT CALCULATIONS BETWEEN 1MeV AND 1eV Final Report, Nov. 1982 - May 1986
Stanley Woolf Apr. 1988 76 p
(Contract F19628-83-C-0017)
(AD-A196754; RADC-TR-88-52) Avail: NTIS HC A05/MF A01 CSCL 20C

This report will describe the development and application of numerical methods for predicting dose and variation in multi-layered structures due to X-rays and gamma rays and the charge build-up in dielectrics due to electron beam irradiation. The scope our work included: development and implementation of: (1) discrete ordinates electron transport calculations for electron sources both within and incident of solid structures; (2) discrete ordinates electron transport calculations for photon sources incident on layered solids; and (3) Monte Carlo calculations and statistical analysis programs for low-energy electron transport in insulating structures. In addition, several photon transport calculations were made to determine the scattered photon energy spectra characteristic of various standard irradiation test facilities. GRA

N89-12369# Stanford Univ., Calif. Dept. of Statistics.
SPEED OF ESTIMATION IN POSITRON EMISSION TOMOGRAPHY
Iain Johnstone and B. W. Silverman (Bath Univ., England) 1987 45 p Sponsored by SERC and ARO
(Contract GM-21215; NSF MCS-84-51750; NSF MCS-86-00235)
(AD-A196948) Avail: NTIS HC A03/MF A01 CSCL 06G

Several algorithms for image reconstruction in positron emission tomography (PET) have been described in the medical and statistical literature. A continuous idealisation of the PET reconstruction problem is studied, considered as an example of bivariate density estimation based on indirect observations. Given a large sample of indirect observations, the size is considered of the equivalent sample of observations, whose original exact positions would allow equally accurate estimation of the image of interest. Both for indirect and for direct observations, the exact minimax rates are established for convergence of estimation, for all possible estimators, over suitable smoothness classes of functions. For indirect data and (in practice unobservable) direct data, these rates are n sup (-p/(p+2)) and (n/log n) sup (-p/(p+1)) respectively, for densities in a class corresponding to bounded square-integrable pth derivatives. Numerical values are obtained for equivalent sample sizes for a particular class of orthogonal series estimators, based on the eigenfunctions of the Radon transform. GRA

N89-12370# Oak Ridge National Lab., Tenn. Physics Div.
UNDERSTANDING THE STRUCTURE OF NUCLEI AT FINITE TEMPERATURES
C. Baktash 1988 4 p Presented at the International Conference on Contemporary Topics in Nuclear Structure Physics, Cocoyoc, Mexico, 9 Jun. 1988
(Contract DE-AC05-84OR-21400)
(DE88-015570; CONF-880639-4) Avail: NTIS HC A02/MF A01

The purpose of this commentary is to briefly review several works on nuclear structure and to enumerate a few of the difficulties encountered in the interpretation of the experimental results. To be brief, comments are confined to the studies in the particle-bound regime, i.e., a temperature range of T less than or equal to 1 MeV. Among the interesting topics to be addressed in this temperature range are the question of thermal fluctuations, and the variations of the pairing correlations, shape parameters, nuclear collectivity, and rotational damping width with spin and excitation energy. DOE

N89-12371# National Inst. of Health, Bethesda, Md.
SURFACE AND MOLECULAR FORCES GOVERNING THE TRANSPORT OF IONS ACROSS ELECTRICALLY EXCITABLE MEMBRANES Annual Report
V. A. Parsegian 15 Apr. 1988 9 p
(Contract N00014-87-G-0187; Proj. RR0-4108)
(AD-A197659) Avail: NTIS HC A02/MF A01 CSCL 07C

The aims of this project are: to measure the internal aqueous volume changes during the gating of ionic channels by trans-membrane voltage; to distinguish between various molecular structural models of channel gating; to connect channel gating and specificity with measurements of intermolecular forces. To this end, we have used osmotic stress to determine that a significant fraction of the internal aqueous volume is lost upon closure of two very different channels, i.e., the anion channel from the outer membrane of mitochondria, and the potassium channel from the squid giant axon. The structural rearrangements that probably accompany such closure require that one recognize the likely motion of channel protein and the energetic importance of channel volume hydration. Protein motion immediately implicates mechanical properties of membrane lipids and proteins as part of the gating process; cavity hydration immediately requires recognition of the specific action of transversing ions on the energy of opening. GRA

N89-12372# State Univ. of New York, Buffalo. Dept. of Chemistry.
ROUGHNESS-INDUCED RESONANCE FOR MOLECULAR FLUORESCENCE NEAR A CORRUGATED METALLIC SURFACE
P. T. Leung, Young S. Kim, and Thomas F. George Jul. 1988 16 p
(Contract N00014-86-K-0043)
(AD-A197685; UBUFFALO/DC/88/TR-79) Avail: NTIS HC A03/MF A01 CSCL 07B

Based on a dynamical energy transfer theory for the molecular decay rate near a rough metallic surface, a new resonance structure is predicted which is mediated by the roughness and which is absent in the static image theory. The implication of this new resonance structure to other phenomena, such as electron energy loss spectrum and cross coupling in thin films, is pointed out. GRA

N89-12373# California Univ., Santa Barbara. Dept. of Physics.
TIME-INDEPENDENT VARIATIONAL APPROACH TO INELASTIC COLLISIONS OF A PARTICLE WITH A HARMONIC OSCILLATOR Technical Report, No. 13, Jun. - Dec. 1988
Yasutami Takada 15 Aug. 1988 37 p
(Contract N00014-84-K-0548)
(AD-A197695) Avail: NTIS HC A03/MF A01 CSCL 20K

A variational approach is applied to collisions of a particle having a mass m with a harmonic oscillator having a mass M in one dimension. We have used trial functions which become exact in the limit of either m/M is much greater than 1 or m/M is dominated by 1. We have derived exact expressions in the limit m/M approaches O for inelastic as well as elastic collisions to leading order in the parameter m/M for any impenetrable interaction potential. GRA

N89-12374# California Univ., Santa Barbara. Dept. of Physics.
SEMICLASSICAL DESCRIPTION OF INELASTIC ATOM SCATTERING BY SURFACES Technical Report, No. 14, Jun. - Dec. 1988
Walter Kohn 15 Aug. 1988 11 p
(Contract N00014-84-K-0548)
(AD-A197696) Avail: NTIS HC A03/MF A01 CSCL 20E

Inelastic scattering of atoms of moderate energies (say less than 5 eV) by solid surfaces is almost entirely due to energy exchange with lattice vibrations. It can give valuable information about the atom-surface interaction potential and the vibrational dynamics at surfaces. Theoretically this process represents a challenging many-body problem, calling for suitable approximation methods. This paper outlines work currently in progress. A simple model problem is solved in which the normal modes of the lattice are schematized by a single one dimentional harmonic oscillator, initially in its groundstate (T = O). The classical solution gives a unique energy loss. The leading quantum correction and a Gaussian final energy distribution found whose width is proportional to sq. rt.(h). The exact results are in general different from the so-called trajectory approximation. A new type of atom-surface scattering experiment is proposed, which will provide a direct measure to the quantum corrections to classical scattering. GRA

N89-12375# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
SPECTROSCOPIC INVESTIGATIONS ON ENERGY TRANSFER BY METASTABLE Xe ATOM COLLISIONS ON N2 AND CO MOLECULES Thesis [SPEKTROSKOPISCHE UNTERSUCHUNG DER ENERGIEUEBERTRAGUNG BEIM STOSS METASTABILER XE-ATOME AUF N2 UND CO MOLEKUELE]
Thomas Kruempelman Nov. 1987 191 p In GERMAN
(MPIS-17/1987; ISSN-0436-1199; ETN-88-93208) Avail: NTIS HC A09/MF A01; Max-Planck Institut fuer Stroemungsforschung, Boettinger Strasse 6-8, 3400 Goettingen, Federal Republic of Germany 39 deutsche marks

Electronic energy transfer by collisions between Xe atoms and N2 and CO molecules are investigated via their emission spectra. A metastable Xe atom beam is obtained by a developed gas discharge facility permitting a hundred times higher spectroscopic resolution. Weak endotherm vibration levels and relative excitation cross sections are investigated in relation with collision energy and measured in crossed molecular beam experiments. ESA

N89-12376# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
INVESTIGATIONS OF FORCE CONSTANTS-RELAXATION ON METAL SURFACES BY MEASUREMENT OF PHONON SCATTERING CURVES USING HELIUM ATOM SCATTERING Thesis [UNTERSUCHUNG DER KRAFTKONSTANTEN-RELAXATION AN METALLOBERFLAECHEN DURCH MESSUNG DER PHONONENDISPERSIONSKURVEN MITTELS HELIUMATOM-STREUUNG]
Christoph Woell Dec. 1987 240 p In GERMAN
(MPIS-18/1987; ISSN-0436-1199; ETN-88-93209) Avail: NTIS HC A11/MF A01; Max-Planck Institut fuer Stroemungsforschung, Boettinger Strasse 6-8, 3400 Goettingen, Federal Republic of Germany 47 deutsche marks

Abnormal longitudinal lattice vibrations on noble metal surfaces are investigated using helium atom inelastic scattering instead of the previous electron scattering method. Surface physical phenomena are outlined to explain important modifications of force constants. Lattice dynamics is studied in the case of lattice vibrations in three dimensional solids and in crystal layers. A computer program is used for the determination of phonon frequencies. Experimental results are given for the interactions of helium atoms with solid surfaces for Pt, Pd, Al, and Pb. ESA

N89-12377# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).

QUARKONIUM PRODUCTION IN HADRONIC INTERACTIONS: PROBING THE GLUON STRUCTURE FUNCTION AT SMALL x VALUES

B. vanEijk and R. Kinnunen (Helsinki Univ., Finland) Jun. 1987 24 p

(NIKHEF-H/87-15; B8735085; ETN-88-93422) Avail: NTIS HC A03/MF A01

The properties of charm and bottom bound state production at present and future hadron colliders are studied. Reasonable agreement exists between calculations and UA1 J/Psi data whereas the agreement with UA1 Upsilon data is fairly good. Based on these observations extrapolations for future hadron colliders are presented. Predictions are dominated by the uncertainties on the gluon structure function at small values of x. Conversely, observation of quarkonium signals at higher energies may serve as a probe for those structure functions at small x values. ESA

N89-12378# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).

THE SPINNING SUPERPARTICLE

J. Kowalski-Glikman, J. W. vanHolten, S. Aoyama, and J. Lukierski (Wroclaw Univ., Poland) Sep. 1987 7 p Sponsored in part by Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas, Netherlands

(NIKHEF-H/87-16; B8737915; ETN-88-93423) Avail: NTIS HC A02/MF A01

Doubly graded massless supersymmetric particle models with both world-line local and space-time global supersymmetry are considered. Quantization of the model with four-dimensional space-time and N=1 world-line SUSY is described. Using the Gupta-Bleuler method, a pair of D=4 chiral spinor superfields with the onshell spectrum containing scalar and vector multiplets are obtained as the super wave-function. ESA

N89-12379# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).

THE SPINNING SUPERPARTICLE. PART 2: A SPECTRUM IN TEN DIMENSIONS

J. Kowalski-Glikman Nov. 1987 10 p Sponsored in part by Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas, Netherlands

(NIKHEF-H/87-19-Pt-2; ETN-88-93425) Avail: NTIS HC A02/MF A01

The quantization of the spinning superparticle model in 10 space-time dimensions is presented. The resulting wave function represents two spin 3/2 multiplets for type 1 and spin 5/2 multiplets for type 2 theories. ESA

N89-12380# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).

THE RISE OF THE PROTON-(ANTI)PROTON TOTAL CROSS SECTION AT TEVATRON ENERGIES AND BEYOND

P. M. Kluit and J. Timmermans Dec. 1987 18 p Submitted for publication

(NIKHEF-H/87-22; B8803931; ETN-88-93427) Avail: NTIS HC A03/MF A01

A dispersion relation analysis of the UA4 result on the real part of the p anti-p elastic scattering amplitude (= 0.24 + or - 0.04) is presented. The interpretation is twofold. Assuming that the pp and p anti-p cross sections are asymptotically identical, a steep rise of the total cross section in the 1 to 4 TeV domain is deduced. If the cross sections are asymptotically different, there is a crossing of the total cross section of pp and p anti-p between ISR and Sp anti-pS energies followed by a steep rise of the difference of the pp and p anti-p total cross sections. It is shown that in both cases this rise can be accounted for by adding an additional term with an energy cut-off to the usual Amaldi parameterization of the total cross section: ln sq (s/scut) in the first case, or ln(s/scuto) in the second case, where sq rt scut lies around 500 GeV and sq rt scuto around 63 GeV. Both quantities can be interpreted as a threshold of a new process. For the first case, a continuous parameterization without a threshold is also proposed with an extra term of the form ln sq (1 + s/s1), where sq rt s1 equals 700 GeV. ESA

N89-12381# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).

PHOTON GLUON FUSION CROSS SECTIONS AT HERA ENERGY

J. J. Engelen, S. J. deJong, M. Poletiek, and J. A. M. Vermaseren Jan. 1988 10 p

(NIKHEF-H/88-2; ETN-88-93429) Avail: NTIS HC A02/MF A01

Cross sections for heavy flavor production through photon gluon fusion in electron proton collisions are presented. The electron photon vertex is taken into account explicitly, and the Q sq of the exchanged photon ranges from nearly zero (almost real photon) to the kinematically allowed maximum. The QCD scale is set by the mass of the produced quarks. The formalism is also applicable to the production of light quarks as long as the invariant mass of the pair is sufficiently high, so cross sections for u anti-u, d anti-d, and s anti-s production are also given. ESA

N89-12382# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).

AN ESTIMATE OF THE RESCATTERING FRACTION IN NEUTRINO- AND ANTINEUTRINO-DEUTERON INTERACTIONS

Armin Tenner 1 May 1988 14 p

(NIKHEF-H/88-6; B8821033; ETN-88-93430) Avail: NTIS HC A03/MF A01

The rescattering fraction of the deuteron was evaluated for neutrino and antineutrino interactions, using 27575 nu and 16896 anti-nu events, observed in a bubble chamber experiment. The obtained values: f = 0.118 + or - 0.003 + or - 0.010 for nu and f = 0.104 + or - 0.007 + or - 0.010 for anti-nu agree with previously estimated values. ESA

N89-12383# Consiglio Nazionale delle Ricerche, Frascati (Italy). Istituto di Fisica della Spazio Interplanetario.

NEUTRON FLUX MEASUREMENTS IN THE GRAN SASSO UNDERGROUND LABORATORY (GSUL) (ITALY) (FIRST PART)

N. Iucci, G. Villoresi, N. L. Zangrilli, R. Bernabei, S. DAngelo, L. Paoluzi, R. Santonico, V. Bidoli (Istituto Nazionale di Fisica Nucleare, Frascati, Italy), F. Re, and F. Signoretti et al. Dec. 1987 13 p

(IFSI-87-18; ETN-88-93465) Avail: NTIS HC A03/MF A01

A neutron detector was mounted in a movable laboratory and installed in the laboratory, where it was irradiated with an Am-Be source in order to measure the pulse height distribution of each counter. The experimental set-up included large BF3 proportional counters, polyethylene and cadmium neutron shields, electronic measuring instruments, and microprocessor data processing. The main peak (94 percent of events) originates from a reaction induced by thermal neutrons. The planning of future experiments is discussed. ESA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N89-12384# Naval Research Lab., Washington, D.C.

AN ELECTRON RING EXTRACTION SCHEME FROM THE MODIFIED BETATRON ACCELERATOR Interim Report

C. A. Kapetanakos, S. J. Marsh, and D. Dialetis 27 Jun. 1988 35 p Prepared in cooperation with Sachs/Freeman Associates, Inc., Landover, Md. and Science Applications, Inc., McLean, Va.

(AD-A196747; NRL-MR-6214) Avail: NTIS HC A03/MF A01 CSCL 20G

This report, describes on an extraction scheme that is easily realizable and has the potential to lead to very high extraction efficiency. The proposed extraction scheme is based on the transformation of the circulating electron ring into a stationary helix, in the toroidal direction, by exciting the resonance that naturally exists for some specific values of the ratio of the vertical to toroidal magnetic field. Transformation of the ring into a helix is achieved with a localized vertical magnetic field disturbance that is generated by an agitator coil. As the minor radius of the helix increases with each passage through the gap of the agitator coil, the electrons eventually reach the extractor, which has the property that all the magnetic field components transverse to its axis are equal to zero. Thus, the electron ring unwinds into a straight beam. A technique is proposed for extracting the electron ring from the modified betatron accelerator. Basically, this technique consists of exciting the resonance that naturally exists for some specific values of the ratio of the vertical to toroidal magnetic field. GRA

N89-12385# NUKEM G.m.b.H., Hanau (West Germany).
SAFETY ASPECTS OF NUCLEAR POWER SOURCES (NPS) FOR ELECTRICITY GENERATION IN SPACE Interim Summary Report, Nov. 1986 - Dec. 1987
H. J. Wingender and H. Pirk Feb. 1988 315 p Sponsored in cooperation with Technische Univ., Brunswick, Fed. Republic of Germany
(Contract BMFT-01-QV-8688-AK/PA2)
(FuE-87062; ETN-88-93229) Avail: NTIS HC A14/MF A01

Existing and future nuclear power sources (NPS) are described, and NPS are compared with other power sources in space. Statistics on NPS incidents are presented, and orbital lifetimes and reentry possibilities are predicted. The consequences and risks of NPS are assessed. ESA

N89-12386# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
SIGNAL EQUALIZATION AND ENERGY RESOLUTION FOR URANIUM/SILICON HADRON CALORIMETERS
Richard Wigmans Sep. 1987 22 p Presented at the Workshop on Experiments, Detectors, and Experimental Areas for the Supercollider, Berkeley, Calif., 7-17 Jul. 1987
(NIKHEF-H/87-13; B8735083; ETN-88-93420) Avail: NTIS HC A03/MF A01

The response of a uranium/silicon hadron calorimeter, one of the options suggested for detecting jets at a hadron supercollider, was studied. It is shown that the e/h signal ratio of such a detector can be made 1.0 (compensation), by means of thin polyethylene foils sandwiching the Si layers. This guarantees signal linearity for hadron detection, and a Gaussian line shape. The energy resolution sigma/E scales with 1/sq rt E, but is considerably worse (larger than 45 percent /sq rt E) than for other (hydrogenous) readout materials. ESA

N89-12387# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
CALORIMETRY AT THE SUPERCONDUCTING SUPERCOLLIDER (SSC)
Richard Wigmans Sep. 1987 30 p Presented at the Workshop on Experiments, Detectors and Experimental Areas for the Supercollider, Berkley, Calif., 7-17 Jul. 1987
(NIKHEF-H/87-14; B8735084; ETN-88-93421) Avail: NTIS HC A03/MF A01

The state of the art, and understanding of the basic limitations in hadron calorimetry are described. Options for superconducting supercollider calorimeters are discussed, and the R and D needed for the ones that look most promising is outlined. The most promising candidates are: (1) lead/scintillating fiber. The questions needing answers concern radiation hardness, e/pi separation, signal uniformity, and stability, and (2) lead (or uranium)/TMS (or other warm liquids). The R and D should concentrate on compensation questions, purity control, high drift fields, safety, and signal speed. The other candidates are uranium/liquid argon, where primarily the hermeticity and compensation problems need satisfactory solutions; and uranium (or tungsten)/silicon, where the radiation damage and cost issues need clarification. ESA

N89-12388# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
A TEST OF CATHODE STRIP READ-OUT FOR THE MULTIWIRE PROPORTIONAL CHAMBERS OF THE INNER DETECTOR OF DELPHI
M. Bonapart, B. deJong, J. Timmermans, and F. Udo Jan. 1988 18 p
(NIKHEF-H/88-1; B8809019; ETN-88-93428) Avail: NTIS HC A03/MF A01

The configuration and testing of proportional chambers of the DELPHI experiment are described. The outer part of the inner detector of the experiment consists of five concentric multiwire proportional chambers (MWPC). The cylindrical cathodes of the MWPC are each divided into 192 strips which form loops around the beam. The analysis of the charge distribution induced on the 150 cm long strips provides the coordinates along the beam of the traversing particle. The comparison between anode charge and total induced cathode charge resolves ghosts in a multitrack event. The five MWPC as a whole function as a track trigger. A flat prototype, equipped with full size cathode strips, was tested with cosmic rays. The spatial resolution is measured to be 130 micron (2.9 percent of the strip width). The rms of ratio distribution of total cathode charge and anode charge is measured to be 2.2 percent. Two track charge distributions are analyzed. This procedure provides single track performance if the hits are separated by at least 7 mm. ESA

N89-12389# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
MISALIGNMENTS, ALLOWABLE MULTIPOLE FIELD CONTENT, BASIC INJECTION PARAMETERS AND BASIC RF PARAMETERS
R. Maas, R. Servranckx, and Y. Wu May 1988 7 p
(NIKHEF-K/APS/88-02; B8821492; ETN-88-93431) Avail: NTIS HC A02/MF A01

Data needed for the design and procurement of hardware components for a storage ring are presented. Alignment errors and multipole contents of the magnets; basic injection parameters; and basic RF parameters are covered. ESA

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N89-12390*# Georgia Inst. of Tech., Atlanta. Microelectronics Research Center.
THEORETICAL AND MATERIAL STUDIES ON THIN-FILM ELECTROLUMINESCENT DEVICES Semiannual Report No. 6, 1 Nov. 1987 - 30 Apr. 1988
C. J. Summers, J. A. Goldman, and K. Brennan Nov. 1988 29 p
(Grant NAG1-586)
(NASA-CR-183343; NAS 1.26:183343) Avail: NTIS HC A03/MF A01 CSCL 20F

During this report period work was performed on the modeling of High Field Electronic Transport in Bulk ZnS and ZnSe, and also on the surface cleaning of Si for MBE growth. Some MBE growth runs have also been performed in the Varian GEN II System. A brief outline of the experimental work is given. A complete summary will be done at the end of the next reporting period at the completion of the investigation. The theoretical studies are included. Author

N89-12391# Stanford Univ., Calif. Dept. of Mechanical Engineering.
FLEXIBLE AUTOMATED OPTICAL SENSING SYSTEMS FOR THE STUDY AND CONTROL OF ENERGY CONVERSION PROCESSES Final Report, 15 Jul. 1984 - 14 Jul. 1987
Charles H. Kruger 11 Aug. 1988 9 p
(Contract DE-FG03-85ER-13393)

(DE88-015807; DOE/ER-13393/T1) Avail: NTIS HC A02/MF A01

Optical sensors integrated with computers are needed for the study and control of energy conversion processes. In this program systematic methods for combining the capabilities of optical sensors and computers to generate advanced optical sensing systems were studied. This research is interdisciplinary and involved investigation of sensors, optical signal analysis, computer integration, as well as the development of facilities for proof of the sensor systems. Of the several approaches and sensor types considered in the exploratory phase of this work, a number were brought to a fruitful position within a university research context where proof-of-concept experiments were performed and the results reported in the literature. In the continuing research, consolidation of the experimental activities was pursued with emphasis on plasmas as providing a rich environment for the investigation of sensor techniques. DOE

N89-12392# Colorado Univ., Boulder. Dept. of Electrical and Computer Engineering.

INSTRUMENTATION REQUEST FOR OPTICAL SYMBOLIC COMPUTING Final Report, 1 Nov. 1986 - 30 Apr. 1988

W. T. Cathey and Kristina M. Johnson 7 Jul. 1988 4 p
(Grant AF-AFOSR-0080-87; AF Proj. 2917)
(AD-A197561; Rept-153-6773-2; AFOSR-88-0737TR) Avail: NTIS HC A02/MF A01 CSCL 12F

The equipment grant was combined with other funds to purchase image processing and simulation equipment. The central purchases were a sun microsystem and a recognition technologies image processing system. In addition to image processing, simulation of two-dimensional optical processing systems has been performed. GRA

N89-12393# Massachusetts Univ., Amherst.

PROCESSING DYNAMIC IMAGES FROM CAMERA MOTION Final Motion Report

1987 19 p
(Contract N00014-82-K-0464)
(AD-A197697) Avail: NTIS HC A03/MF A01 CSCL 17E

Topics addressed include: Overview Restricted Motion; General Motion and Computation of the Optical Flow Field; Multiresolution Methods; General Motion and Inherent Ambiguities; Processing Approximate Translational Motion for the ALV; Stereoscopic Motion Analysis; Analysis of Constant General Motion; Interpretation; and Publications. GRA

N89-12394# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.

HYBRID (OPTICAL/ELECTRONIC) COMPUTING AND DIGITAL COMPUTING Annual Technical Report, 1 Mar. 1987 - 29 Feb. 1988

Sing H. Lee 1 Jun. 1988 37 p
(Grant AF-AFOSR-0371-85; AF Proj. 2305)
(AD-A197722; AFOSR-88-0739TR) Avail: NTIS HC A03/MF A01 CSCL 12I

The program consists of two areas of optical information processing: (1) optical-analog/electronic hybrid computing for optical image processing, optical pattern recognition and solution of partial differential equations, and (2) nonlinear optical devices and digital optical computing. The optical-analog/electronic digital hybrid system consist of an analog optical processor with input/output interfaces to a microcomputer. The analog optical processor is employed to perform time consuming computations, while the logical decisions and controls are provided by an electronic microcomputer. For image processing we have implemented, with hybrid systems, numerous space-variant transformations (e.g., Hough transform for detection of high-order parametric curves, coordinate transform for rotation and scale invariant feature extraction, etc.). GRA

N89-12395# Heinrich-Hertz-Inst. fuer Schwingungsforschung, Berlin (West Germany).

COHERENT OPTICAL BROADBAND TRANSMISSION IN LONG-DISTANCE TRUNK SYSTEMS Final Report, 30 Jun. 1987

Hans-Georg Weber, E. Dietrich, G. Elze, B. Enning, R. Gross, G. Grosskopf, W. Haessler, C. vonHelmolt, H. Knupke, and L. Kueller et al. Bonn, Fed. Republic of Germany BMFT Oct. 1987 112 p In GERMAN; ENGLISH summary Sponsored by BMFT
(ETN-88-93224) Avail: NTIS HC A06/MF A01

The application of traveling wave optical amplifiers (semiconductor-laser amplifiers) in long distance multichannel coherent optical broadband transmission systems was investigated. The traveling wave optical amplifiers were realized by antireflection coating of 1.3 micron GaInAsP-lasers with SiO/SiO_2 to give reflectivities of less than 0.1 percent. The optical amplifiers have a gain of more than 20 dB at a gain ripple of less than 3 dB and a 3 dB bandwidth of 40 nm. It is shown that the implementation of an optical amplifier into a two channel 560 Mbit/s DPSK heterodyne transmission system enables an increase of the transmission length from 29 km to 71 km without deterioration of the bit error rate. ESA

N89-12396# National Aerospace Lab., Amsterdam (Netherlands). Space Div.

DEVELOPMENT OF AN OPTICAL DIAGNOSTIC INSTRUMENT. PART 1: EXECUTIVE SUMMARY Final Report

D. vandenAssem and R. H. Huijser 15 Jun. 1987 43 p
(Contracts ESA-5188/82-NL-HP(SC); ESA-6533/85-NL-IW(SC); NIVR-423-02405-N)
(NLR-TR-87079-U-Pt-1; B8817853-Pt-1; ETN-88-93383) Avail: NTIS HC A03/MF A01

An optical diagnostic instrument for fluid physics research in the microgravity environment of a space laboratory is presented. The instrument offers a whole field observation system with a Schlieren overlay combined with a local narrow field observation capability, the stake system. The latter allows for operation of a variety of optical instruments, of which two types were evaluated in a test setup: an equal path interferometer and a moire deflectometer. The development of the narrow field stake system with its accomodation capability of easily exchangeable optical diagnostics is described. The whole field Schlieren system and stake system performance were assessed experimentally. A design for a flight instrument suited for accomodation in a space laboratory is given. ESA

N89-12397# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

OPTICAL DATA STORAGE IN SPACE MISSIONS

L. J. M. Joosten, R. M. M. Sijmonsma, F. B. Visser, and W. E. Reesink (Van der Heem Electronics N. V., Rijswijk, Netherlands) 20 Mar. 1987 21 p Presented at the Symposium on Technology and Standardization for On-Board Data Management Systems, Madrid, Spain, 1-5 Jun. 1987
(Contract NIVR-425-02602N)
(NLR-MP-87027-U; B8805846; ETN-88-93395) Avail: NTIS HC A03/MF A01

Optical mass storage of digital data (CD-ROM, WORM) for use in space missions was assessed. Upgrading of commercial devices seems feasible, while ground support can be done by common equipment and software. ESA

N89-12398*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FACILITY FOR INTERFEROMETRIC TESTING OF 1.25-m MIRRORS AT LIQUID HELIUM TEMPERATURES

Louis J. Salerno and Ramsey K. Melugin Oct. 1988 14 p
(NASA-TM-101017; A-88253; NAS 1.15:101017) Avail: NTIS HC A03/MF A01 CSCL 20F

A concept is presented for a national cryogenic optics test facility capable of optical characterization of 1.25 m diameter optics having focal lengths up to 6.2 m at temperatures from 300 K to near 4 K. The facility will be comprised of a large Dewar with a phase shift interferometer, a two stage vacuum system employing a turbomolecular pump, and an integral vibration isolation system. The entire facility will be housed in a concrete site with a massive floor to assist in reducing vibration during optical tests. By providing interchangeable sections, the overall height of the Dewar can be adjusted to provide for testing of shorter focal length optics. The background for the facility is discussed along with the facility location, and the requirements and the performance considerations which drive the Dewar design with respect to the vibration isolation system, vacuum system, and optical interferometry. Author

N89-11882# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF OPTICAL ISOLATOR MATERIALS, APPLICATIONS
Katsumi Machida, Kazuhiro Nakajima, and Haruo Ishikawa *In its* JPRS Report: Science and Technology. Japan 12 Apr. 1988 p 1-17 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Oct. 1987 p 13-20 (For primary document see N89-11881 03-27)
Avail: NTIS HC A06/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N89-12399# TRW Space Technology Labs., Redondo Beach, Calif. Applied Technology Div.
SPACE POWER MHD (MAGNETOHYDRODYNAMIC) SYSTEM Quarterly Technical Progress Report No. 3, 1 Nov. 1987 - 31 Jan. 1988
15 Mar. 1988 28 p
(Contract DE-AC22-87PC-79662)
(DE88-013085; DOE/PC-79662/T3; K535.88.RH-071) Avail: NTIS HC A03/MF A01

This progress report of the Space Power MHD System project presents the accomplishments during 1 November 1987 through 31 January 1988. The scope of work covered encompasses the definition of an MHD power system conceptual design and development plan (Task 1). Progress included the following: Subcontracts were issued to the MIT Plasma Fusion Center and the Westinghouse R and D Center. The performance of the 100 MW 500 sec. power system was optimized and the design concept finalized, including mass and energy balances. Mass and cost estimates were prepared. A design review was held at DOE/PETC. This also included the review of the technical issues definition and of the R and D Plan. Following the review, a final iteration on the conceptual design was initiated. Formulation of the R and D Plan was continued. Preparation of the Task 1 R and D Report was initiated. DOE

N89-12400# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
GAMMA-RAY DIAGNOSTIC FOR THE COMPACT IGNITION TOKAMAK
R. D. Petrasso, C. L. Fiore, and Chi-Kang Li Apr. 1988 9 p Presented at the 7th Topical Conference on High Temperature Plasma Diagnostics, Napa, Calif., 13 Mar. 1988
(Contract DE-AC02-78ET-51013)
(DE88-011525; PFC/JA-88-17; CONF-880364-31) Avail: NTIS HC A02/MF A01

We have examined the feasibility of a fusion gamma-ray diagnostic for the compact ignition tokamak, which is expected to produce 10 to the 20th power (d,t) fusion reactions per second. Gamma rays at 16.7 MeV are produced by the t(d,gamma) He^5 fusion reaction. A Monte-Carlo coupled neutron-photon transport code is used to model the expected gamma-ray spectrum incident upon a Compton spectrometer backed by a Cerenkov detector. The results indicate that a signal of approximately 3 x 10 to the 4th power cts/s and a signal-to-noise ratio of approximately 30 can be achieved. DOE

N89-12401# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PROCEEDINGS OF THE FIRST JAPAN/US FFTF/MOTA EXPERIMENTERS' WORKSHOP
Donald G. Doran, ed., Shiori Ishino, ed. (Tokyo Univ., Japan), and Chusei Namba, ed. Apr. 1988 258 p Workshop held in Tokyo, Japan, 24-26 Aug. 1987
(IPPJ-866; ISSN-0469-4732) Avail: NTIS HC A12/MF A01

The First Experimenters' Workshop on FFTF/MOTA, the Japan-US collaboration program in Fundamental Studies of Irradiation Effects in Fusion Materials is presented. The workshop was held for the benefit of scientists who are engaged in the utilization of the FFTF/MOTA. The workshop is designed to provide the most up-to-date information of FFTF/MOTA operations. It is also for the exchange of information on the experimental matrices for FFTF/MOTA Cycle 10 from both sides and on the strategy of both Japan and the US for the planning of FFTF/MOTA Cycle 11. Areas are sought for areas for joint research, including those utilizing preirradiated specimens. For individual titles, see N89-12402 through N89-12403.

N89-12402# Tokyo Univ. (Japan). Dept. of Nuclear Engineering.
JAPANESE MATERIALS PROGRAM AND FFTF
Shiori Ishino *In* Nagoya Univ., Proceedings of the First Japan/US FFTF/MOTA Experimenters' Workshop Apr. 1988 p 23-33 (For primary document see N89-12401 03-75)
Avail: NTIS HC A12/MF A01

Japanese materials program is briefly reviewed and the associated university program, which is still in a provisional stage, is described in some detail. Important elements of the university proposal are: (1) construction of a high energy high fluence neutron irradiation facility, (2) establishment or expansion of local research centers including hot laboratories, and (3) promotion of fundamental studies. The FFTF/MOTA Project is a very important constituent of the whole program, the results coming out of which should be well coordinated with other fundamental research programs to extract full essence needed for the advancement or realization of fusion energy. Author

N89-12403# Tokyo Univ. (Japan). Dept. of Materials Science.
FFTF-CYCLE 10 PROGRAM AND FUTURE PLAN
Akira Kohyama *In* Nagoya Univ., Proceedings of the First Japan/US FFTF/MOTA Experimenters' Workshop Apr. 1988 p 34-56 (For primary document see N89-12401 03-75)
Avail: NTIS HC A12/MF A01

Brief outlines are provided of the FFTF cycle 10 program and future plans in consideration. The primary objective of the Japan-US collaboration program is to enable predictions of material behavior in MFRs to be made from data obtained in other irradiation environments. Major program goals are outlined. Author

N89-12404# Sandia National Labs., Albuquerque, N. Mex.
INTENSE LIGHT-ION-BEAM DIODES
D. L. Cook, M. P. Desjarlais, S. A. Slutz, T. R. Lockner, D. J. Johnson, S. E. Rosenthal, J. E. Bailey, R. S. Coats, R. J. Leeper, and J. E. Maenchen et al. 1988 10 p Presented at the 7th International Conference on High-Power Particle Beams, Karlsruhe, Federal Republic of Germany, 4 Jul. 1988
(Contract DE-AC04-76DP-00789)
(DE88-012859; SAND-88-0064C; CONF-880713-4) Avail: NTIS HC A03/MF A01

Intense light ion beam diodes are being developed as sources for Inertial Confinement Fusion. Research efforts are being carried out world wide. Progress in understanding the physics of ion diodes has been rapid. In particular, diodes using externally applied magnetic fields have been scaled to very large levels of power and energy on the Particle Beam Fusion Accelerator (PBFA II) at Sandia National Laboratories. Our present understanding of the physics of these diodes is described, and critical issues which need to be addressed in future research are discussed. DOE

N89-12405*# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
NET CURRENT MEASUREMENTS AND SECONDARY ELECTRON EMISSION CHARACTERISTICS OF THE VOYAGER PLASMA SCIENCE EXPERIMENT AND THEIR IMPACT ON DATA INTERPRETATION
Ralph L. McNutt, Jr. Sep. 1988 195 p
(Grant NGL-22-009-015)
(NASA-CR-181351; NAS 1.26:181351; CSR-TR-88-6) Copyright
Avail: NTIS HC A09/MF A01 CSCL 20I

The Voyager Plasma Science (PLS) instrument is capable of returning integral (DC) current measurements, similar in some respects to measurements made with a Langmuir probe or a retarding potential analyzer, although there are significant differences. The integral measurements were made during a calibration sequence in the solar wind, during Cruise Science Maneuvers, and within the magnetospheres of Jupiter and Saturn by Voyager 1. After the failure of the PLS experiment following the Saturn encounter, that instrument was placed in the DC return mode returning possibly usable data from early 1981 through early 1985. The DC return measurements are difficult to interpret and are above threshold values only for relatively large fluxes; the determination of the measured current level is dependent on the operating temperature of the preamplifiers which further complicates the interpretation. Nevertheless, these measurements can be used to determine the efficiency of the suppressor grid at preventing the loss of secondary electrons off the collector plate. Some DC return measurements have been invaluable in aiding in the interpretation of some electron plasma measurements not previously understood. It is found that electron spectra can be significantly modified by the presence of second generation secondary electrons produced by either first generation secondaries or photoelectrons on the support ring of the negative high voltage modulator grid within the instrument housing. Author

N89-12406# Texas Univ., Austin. Dept. of Physics.
NONLINEAR EVOLUTION OF A FORCE-FREE ARCADE FIELD DRIVEN BY SHEAR FLOW
N. Bekki, T. Tajima, J. W. VanDam, Z. Mikic, D. C. Barnes, and D. D. Schnack (Science Applications International Corp., San Diego, Calif.) Jul. 1988 14 p
(Contract DE-FG05-80ET-53088)
(DE88-013560; DOE/ET-53088/327; IFSR-327) Avail: NTIS HC A03/MF A01

The nonlinear evolution of a force-free magnetic field driven by slow shear flow on a boundary is investigated analytically and numerically. The Woltjer-Taylor theory is generalized to obtain the time-dependent magnetohydrodynamic (MHD) solution for the nonlinear force-free fields driven by shear flow. This solution agrees well with our resistive MHD simulations, which show that the force-free arcade field in a solar coronal plasma evolves quasi-statically through a series of force-free states before reconnection occurs. DOE

N89-12407# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PROCEEDINGS OF THE 2ND US-JAPAN WORKSHOP ON ADVANCED PLASMA MODELING, VOLUME 2
Mar. 1988 136 p Workshop held in Nagoya, Japan, 23-27 Mar. 1987
(IPPJ-863; ISSN-0469-4732) Avail: NTIS HC A07/MF A01

The proceedings of this conference are presented. Details of modeling techniques, their advantages and disadvantages, how they might be improved and what types of physics problems could be treated were discussed. Many powerful new techniques for handling large time step, large space scale problems were developed. For individual titles, see N89-12408 through N89-12422.

N89-12408# Texas Univ., Austin. Inst. for Fusion Studies.
GENERALIZED REDUCED MHD, AND FULL MHD CALCULATIONS WITH SEMI-IMPLICIT TECHNIQUES Abstract Only
A. Aydemir *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 1 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

The Four-Field model of Hazeltine et al. generalizes the well-known reduced MHD (RMHD) equation to include parallel and perpendicular compressibility, diamagnetic drift frequencies, and pressure gradients in the parallel Ohm's law. This model is applied to the study of drift tearing modes in tokamaks; newly found Alfven resonant modes are discussed. Applications of recently developed semi-implicit techniques for efficient treatment of shear Alfven waves, ion sound waves, and semi-collisional terms are presented. Semi-implicit techniques are discussed in the context of non-reduced, full MHD equations also. Fully toroidal, linear and nonlinear studies of $m = 1$ modes in tokamaks are presented and discussed in terms of their application to fast saw-tooth crashes. Author

N89-12409# Science Applications International Corp., San Diego, Calif.
SEMI-IMPLICIT METHODS FOR 3-D MHD COMPUTATIONS Abstract Only
D. D. Schnack *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 1 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

Nonlinear MHD systems often evolve on time scales that are long compared to those associated with the fastest normal modes of the system. Stability restrictions placed on explicit temporal approximations may result in uneconomically small time steps, while the fully implicit treatment of nonlinear terms requires iteration, or results in unacceptably large matrices. Recently, a new class of methods for solving the time-dependent MHD equations, based on an algorithm developed for long-range weather simulation, has been introduced. These semi-implicit methods allow very large time steps, yet avoid the complexity and large memory requirements associated with implicit methods. In the semi-implicit methods for MHD new terms are added to the time-discretized equations that do not affect the consistency of the solution, yet provide a simple and efficient means of enhancing stability. This method is unconditionally stable with respect to all Alfven modes, and consequently permits such large time steps that accuracy becomes the most important consideration in the choice of step size. Author

N89-12410# Japan Atomic Energy Research Inst., Naka. Dept. of Thermonuclear Fusion Research.
NONLINEAR EVOLUTION OF FREE-BOUNDARY MODE IN A TOKAMAK
Gen-ichi Kurita, Tomonori Takizuka, Masafumi Azumi, and Tatsuoki Takeda *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 13-33 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

Nonlinear MHD calculations of the $m/n=2/1$ free-boundary mode including tearing mode in a cylindrical tokamak are carried out by taking account of the parallel diffusion of resistivity. When 1.75 less than q sub a approx. less than 1.9 for q sub o/q sub a = 0.5 (q sub o is the safety factor at the magnetic axis and q sub a is that at the plasma surface), the plasma column shrinks with the elliptic deformation, the value of q sub a is decreased in time, the plasma becomes stable against the $m/n=2/1$ mode, and finally damping oscillation is observed. Interaction between the plasma and material limiter causes the shrinkage for all the unstable values of q sub a to free-boundary mode. This plasma shrinkage is a candidate of the major disruptions in the tokamak discharge with q sub a around 2. Author

N89-12411# Hiroshima Univ. (Japan). Faculty of Science.
A SIMULATION OF DRIVEN RECONNECTION BY A HIGH PRECISION MHD CODE
Kanya Kusano, Yasuo Ouchi, Takaya Hayashi, Ritoku Horiuchi, Kunihiko Watanabe (Science Project Corp., Hiroshima, Japan), and Tetsuya Sato *In* Nagoya Univ., Proceedings of the 2nd

US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 34-46 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

A high precision MHD code, which has the fourth order accuracy for both the spatial and time steps, is developed, and is applied to the simulation studies of two dimensional driven reconnection. It is confirmed that the numerical dissipation of this new scheme is much less than that of two-step Lax-Wendroff scheme. The effect of the plasma compressibility on the reconnection dynamics is investigated by means of this high precision code. Author

N89-12412# Nagoya Univ. (Japan). Research Inst. of Atmospherics.
AN MHD SIMULATION OF THE SOLAR WIND AND COMETARY PLASMA (AN MHD MODEL WITH PLASMA PRODUCTION)
T. Ogino, R. J. Walker, and M. Ashour-Abdalla (California Univ., Los Angeles.) *In its* Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 47-59 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

Interaction between the solar wind and the plasmas produced from cometary gases was modeled by using a three-dimensional time-dependent magnetohydrodynamic (MHD) simulation with the cometary mass loading. The model reproduced several features observed by the recent missions to comet Halley. A weak bow shock was located at 3.2 x 100000 km in front of the comet. The magnetic field increased by a factor of 3.7 across this weak bow shock and continued to increase up to the contact surface. The plasma temperature increased across the bow shock and decreased nearer to the comet. IMF lines were hung up on the comet and formed a long plasma tail in which the lobe field was quite strong. A cold dense plasma sheet formed in the tail and this thin plasma sheet was oriented normal to the IMF direction. Author

N89-12413# California Univ., Los Angeles. Dept. of Physics.
A HYBRID VLASOV-FLUID MODEL WITH KINETIC IONS AND MASSLESS FLUID ELECTRONS Abstract Only
John M. Dawson *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 6 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

Two-and three-dimensional models were developed with kinetic ions and massless fluid electrons. The use of fluid electrons allows the elimination of the electric field so that it never has to be solved for. A Vlasov equation is then derived for the particle ions and the linear dispersion relation is obtained from it. The results are compared from this theory with simulation results; excellent agreement is found. The model exhibits Alfven waves, ion cyclotron waves, low frequency whistler waves and ion Bernstein waves. The model was used to simulate instabilities such as might be caused by the injection of an energetic neutral beam into the plasma. A two time step correction technique was implemented into code which improves energy conservation by a factor of 10(3) and allows the use of time steps which are an order of magnitude larger. Author

N89-12414# Princeton Univ., N. J. Plasma Physics Lab.
GYROKINETIC PARTICLE SIMULATION OF FINITE-BETA PLASMAS Abstract Only
W. W. Lee, T. S. Hahm, and R. D. Sydora (California Univ., Los Angeles.) *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 6 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

Gyrokinetic particle simulation for finite-beta plasmas is discussed. The four main topics are: (1) the basic formulation of the nonlinear gyrokinetic equations including magnetic perturbations; (2) numerical properties of the simulation plasma such as time step, grid spacing and noise level; (3) special techniques for the evaluation of the generalized Ohm's law; and (4) the relationship between the gyrokinetic equations and the MHD equations. Author

N89-12415# Hiroshima Univ. (Japan). Inst. for Fusion Theory.
MACROSCALE PARTICLE SIMULATION OF KINETIC ALFVEN WAVES
Motohiko Tanaka, Tetsuya Sato, and Akira Hasegawa (Bell Telephone Labs., Inc., Murray Hill, N. J.) *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 62-75 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

Simulation of the kinetic Alfven wave, which has many applications in space and fusion plasmas, was performed by using macroscale (magnetohydrodynamic scale) particle simulation code. Dispersion properties and wave-particle interactions of the kinetic Alfven wave (such as Landau damping and electron acceleration) are successfully obtained in the simulation. Author

N89-12416# Osaka Univ. (Japan). Inst. of Laser Engineering.
PARTICLE-PARTICLE PARTICLE-MESH CODE FOR NONIDEAL HIGH DENSITY PLASMA AND ITS APPLICATION ON RAYLEIGH-TAYLOR INSTABILITY IN ICF PLASMA Abstract Only
Katsunobu Nishihara *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 7 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

In an inertial confinement fusion plasma, the Coulomb coupling constant, becomes of the order of one. In such a strongly coupled plasma, the Coulomb interaction can not be treated as perturbations and the system begins to exhibit features qualitatively different from those in an ideal collisionless plasma. To study dynamics of a strongly coupled plasma, three dimensional two-component particle-particle particle-mesh code was developed. The code calculates exact Coulomb forces among particles within a short distance, while the PIC method is used for long distance forces. The pair distribution functions were observed and the result was found to agree well with the hypernetted chain theory and Thomas-Fermi model. The code was used to study effect of a contact potential on the Rayleigh-Taylor instability between two plasmas with different charge state. The preliminary results are discussed. Author

N89-12417# Nagaoka Technological Univ., Niigata (Japan).
TRIPIC: TRIANGULAR-MESH PARTICLE-IN-CELL CODE FOR LIB DIODE
Shigeo Kawata, Masami Matsumoto, and Yukio Masubuchi *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 77-88 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

A particle-in-cell code using triangular meshes (TRIPIC code) is described to simulate the motion of charged particle in an electromagnetic field self-consistently in some complicated computational space region. TRIPIC is fitted for the simulation of LIB (Light Ion Beam) diode, for example. Author

N89-12418# Hitachi Ltd. (Japan). Energy Research Lab.
A DOMAIN DECOMPOSITION AND OVERLAPPING TECHNIQUE METHOD FOR 3D LARGE SCALE NUMERICAL SIMULATION Abstract Only
Kazuyoshi Miki *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 8 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

A direct-solution scheme for numerically solving the 3-dimensional Poisson's problem with arbitrarily shaped boundaries was developed by using a boundary-fitted coordinate transformation. The scheme also used the technique of decomposing the closed domain into several hexahedron subdomains and then overlapping hexahedrons to deal with complicated geometries. A large system of the linear equations derived from discretizing the Poisson's equation was solved by a biconjugate gradient method with incomplete LU factorization of the nonsymmetric coefficient matrix as preconditioning. The convergence behavior of the different domain decompositions was demonstrated for a numerical experiment. Application to the electrostatic field problem in the electron gun of a color picture tube confirms that the present numerical scheme should provide an efficient and convenient tool for solving many important large-scale engineering problems. Author

N89-12419# California Univ., Los Angeles. Dept. of Physics.
SUBTRACTION TECHNIQUE FOR PLASMA PHYSICS AND EVALUATING NUMERICAL EFFECTS IN CODES Abstract Only
Viktor K. Decyk *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 9 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

A technique was developed for simulation of subtle effects in plasmas. This technique consists of performing the simulation twice. The first time one simulates the background plasma, and the second time one uses exactly the same initial conditions plus some small perturbation, such as an extra test charge, or test wave, etc. One then subtracts the results from each of the simulations, to see only the effect of the perturbation. This method was used to measure precisely the wake field excited by a single electron out of millions. This technique can be applied to new codes in several ways. It can be used as an extremely demanding test to verify that new codes are behaving correctly. It can also be used to explore the physical behavior of new models, where the physical properties are not well understood because of numerical approximations used, such as in implicit codes. Author

N89-12420# Lawrence Livermore National Lab., Calif.
NUMERICALLY INDUCED STOCHASTICITY AND LONG-TIME BEHAVIOR OF NUMERICAL TRAJECTORIES: SMALL DELTA T ANALYSIS
Alex Friedman and Steven P. Auerbach (Berkeley Research Associates, Inc., Calif.) *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 91-99 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

In a one-dimesnional anharmonic potential well, the period of an orbit is a function of its energy. The true motion in such a well is regular, since energy conservation constrains the velocity v at each value of the coordinate x. Nontheless, when the orbit is computed numerically, stochastic behavior can result. Simple integrators were considered as mappings from (x,v) at one time level to (x,v) at the next. Author

N89-12421# Osaka Univ. (Japan). Inst. of Laser Engineering.
REDUCED ATOMIC MODEL FOR CALCULATION OF CHARGE STATE DISTRIBUTION IN MULTIPLY-CHARGED PLASMAS
Takashi Yabe *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 100-129 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

A method to treat particle production and annihilation in particle code is proposed. This method does not directly produce particles and hence can be used with less noise. An example is given for a beat wave accelerator. The density change of 0.06 percent during one plasma period can seriously affect the excitation of plasma waves. In addition, a new method to economically solve atomic processes is proposed, which can be coupled with particle codes. Finally, the coupling between non-LTE free and bound electrons is analyzed with a simple analytical model and its importance in real systems is pointed out. Author

N89-12422# Lawrence Livermore National Lab., Calif.
INDEPENDENT PARTICLE TIMESTEPS
Alex Friedman *In* Nagoya Univ., Proceedings of the 2nd US-Japan Workshop on Advanced Plasma Modeling, Volume 2 Mar. 1988 p 130-134 (For primary document see N89-12407 03-75)
Avail: NTIS HC A07/MF A01

A long-standing goal in plasma simulation has been a method which could treat both detailed kinetic physics and smooth large-scale physics in an efficient and natural way. Until recently, particle simulations were applied almost exclusively to problems of microscopic physics, where only a small part of the plasma was modeled. With the advent of implicit particle simulation techniques, one can now treat systems of many Debye lengths and follow them for many plasma oscillation times. However, the price paid for this capability is a restriction on the allowed spatial resolution (an accuracy constraint). Thus, at the current state-of-the-art (e.g., in codes such as TESS or AVANTI) a small timestep is still necessary whenever the system incorporated a physically-important small spatial or temporal scale anywhere within its domain. A new particle-in-cell plasma simulation technique which relaxes these restrictions and would be suitable for strongly inhomogeneous problems involving a wide range of space and in time scales is being developed. Author

N89-12423# Texas Univ., Austin. Inst. for Fusion Studies.
NONLINEAR GROWTH OF THE QUASI-INTERCHANGE INSTABILITY
F. L. Waelbroeck Jul. 1988 25 p
(Contract DE-FG05-80ET-53088)
(DE88-015536; DOE/ET-53088/331; IFSR-331) Avail: NTIS HC A03/MF A01

In this paper nonlinear effects on the growth of a pressure-driven, interchange-like mode are investigated. This mode is thought to be responsible for the sawtooth crashes observed in the Joint European Torus (JET) and successfully accounts for most of their features. The analysis presented here differs from previous bifurcation calculations by the inclusion of toroidal coupling effects. Toroidal curvature, which is important for pressure-driven modes, destroys the helical symmetry which is typical of kink-like instabilities. DOE

N89-12424# Nagoya Univ. (Japan). Inst. of Plasma Physics.
POTENTIAL FORMATION IN AN RF-PLUGGED AXISYMMETRIC MIRROR-CUSP DEVICE
K. Adati, R. Kumazawa, H. Fujita, T. Oda, K. Kadota, K. Takiyama, M. Hamamoto, T. Ohgo, T. Watanabe (Hiroshima Univ., Japan), and T. Aoki Aug. 1988 11 p Prepared in cooperation with General Atomic Co., San Diego, Calif.
(IPPJ-883; ISSN-0469-4732) Avail: NTIS HC A03/MF A01

Two experiments are described: the first measurements of enhanced RF electric field at the RF plug section and resulting formation of the RF plug potential, and the mechanisms of the plasma potential formation in the central section. Author

N89-12425# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
EXCITATION OF INSTABILITIES DUE TO AN EXTERNAL FIELD Final Technical Report, 10 Feb. 1986 - 31 Aug. 1987
Ken-Ichi Nishikawa 18 Apr. 1988 8 p
(Contract N00014-86-K-2006)
(AD-A196561) Avail: NTIS HC A02/MF A01 CSCL 20I

A new mechanism can destabilize electrostatic waves in the presence of a nonuniform electric field perpendicular to the uniform ambient magnetic field. When the electric field is nonuniform, it is possible for a finite region to contain negative wave energy surrounded by regions of positive wave energy which will cause the mode to grow. This gives rise to the instability. The ion-cyclotron instability is important to both space and laboratory plasma. This new mechanism is investigated for an instability by means of simulations in the presence of a nonuniform electric field perpendicular to the uniform magnetic field associated with a density gradient. A two-dimensional electrostatic code was used which retains the full dynamics of the ions in three dimensional velocity space. Electrons are treated by the guiding center approximation in the perpendicular direction while the parallel motion is treated exactly. Nonlinear phenomena such as diffusion and coalescence of vortices are investigated. In the linear stage smaller vortices are generated and larger vortices with the lower frequencies are dominant in the nonlinear stage. In the nonlinear stage, ions diffuse strongly due to large-scale vortices. GRA

N89-12426# Department of Energy, Washington, D. C. Assistant Secretary for Fossil Energy.
MHD (MAGNETOHYDRODYNAMICS) PROGRAM PLAN, FY88
Apr. 1988 38 p
(DE88-009233; DOE/FE-0104) Avail: NTIS HC A03/MF A01

The essential elements of the current program, which are based on the June 1984 Coal-Fired Magnetohydrodynamic (MHD) Preliminary Transition and Program Plan, are to: (1) develop technical and environmental data for the integrated MHD topping cycle system through long-term (1000 hours) proof of concept (POC) testing; (2) develop technical and environmental data for the integrated MHD bottoming cycle subsystem through long-term (4000 hours) POC testing; (3) design and construct a seed regeneration system capable of independent operation, using spent seed materials from the MHD process; (4) prepare a conceptual design for an MHD retrofit plant; and (5) continue system studies and supporting research necessary for system testing. Results of the topping cycle POC tests at the Component Development and Integration Facility (CDIF), coupled with the bottoming cycle POC test results obtained at the Coal Fired Flow Facility (CFFF), and the seed regeneration POC effort will provide the critical engineering data base for the private sector's final decision on proceeding with the design, construction, and operation of an MHD retrofit. The development schedule, decision points, and resource requirements are shown. DOE

N89-12427# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).
DETERMINATION OF PLASMA BOUNDARIES IN THE EXPERIMENTS WITH COMPACT TORUS
V. M. Goloviznin, V. I. Romanovskij, V. N. Semenov, and V. V. Chudanov 1987 8 p In RUSSIAN
(DE88-703137; IAE-4423/7) Avail: NTIS (US Sales Only) HC A02/MF A01

A problem of determination of the plasma boundary profile has appeared in experiments with a compact torus. A method for solving the inverse problem providing for appreciable specification of a separatrix shape, as compared to the earlier methods, is proposed. According to the measured distribution of external magnetic field along the discharge tube and magnetic flux through the torus the separatrix shape, separating closed and opened, is calculated. Different approximations are studied. DOE

N89-12428# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).
HETEROGENEOUS EQUILIBRIUM STATES OF EMITTING Z-PINCHES
N. A. Bobrova, T. L. Razinkova, and P. V. Sasorov 1987 24 p In RUSSIAN
(DE88-703306; ITEF-128(1987)) Avail: NTIS (US Sales Only) HC A03/MF A01

Physical conditions, under which the existence of highly heterogeneous equilibrium state of emitting Z-pinches is possible, are determined qualitatively. In the found range of parameters the system of equations is formulated, solutions of which describe the equilibria mentioned. For the purpose the radiation model of heavy element plasma (20 less than or equal to Z less than or equal to 80) is developed, which takes into account in the framework of local thermodynamic equilibrium the n,l - greater than n, l-1 transitions and obstruction of radiating ability in the range of low temperatures, where the transitions mentioned are not excited. In the model formulated in case of coordinated increase in the pinch and current per unit length mass the role of heat conductivity decreases but no radiation collapse of the pinch central part takes place, which leads inevitably to pinch plasma stratification into cold and hot phases. DOE

N89-12429# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).
PERIPHERAL PLASMA DYNAMICS DURING NECK DEVELOPMENT IN Z-PINCH DEVICES
P. V. Sasorov 1987 18 p In RUSSIAN
(DE88-703307; ITEF-130(1987)) Avail: NTIS (US Sales Only) HC A03/MF A01

Peripheral plasma dynamics during deep development of commutation in stability under physical conditions characteristic for Z pinch and plasma focus devices is considered. This dynamics determines peripheral plasma parameters till the time when it begins to affect neck development dynamics. The discussion is performed proceeding from obtained during this work analytical solutions of corresponding equations of magnetic hydrodynamics. Situation when finiteness of the peripheral plasma inertia pays an important role, e.g. during current break in pinch plasma and problem of regular acceleration of peripheral plasma ions have been considered. DOE

N89-12430# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
PLASMA FOCUS AND Z-PINCH
H. Schmidt Nov. 1987 32 p Presented at the 2nd Latin American Workshop on Plasma Physics and Controlled Thermonuclear Fusion, Medellin, Columbia, 16-28 Feb. 1987
(IPF-87-5; ETN-88-93218) Avail: NTIS HC A03/MF A01

Plasma dynamics and plasma properties in a plasma focus; fusion reactions; applications of plasma focus; and Z pinch research are reviewed. ESA

N89-12431# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
[ACTIVITIES REPORT OF THE INSTITUTE FOR PLASMA RESEARCH] Annual Report, 1987
1987 21 p
(ETN-88-93219) Avail: NTIS HC A03/MF A01

Research in electron cyclotron resonance heating; plasma theory; laser diagnostics; plasma focus; stellarators; and plasma technology is summarized. ESA

N89-12432# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
NEUTRON EMISSION AND DYNAMICS OF PLASMA FOCUS POSEIDON WITH ALUMINUM OXIDE INSULATOR IN THE OPERATIONAL RANGE 280 TO 500 kJ [NEUTRONENEMISSION UND DYNAMIK DES PLASMAFOKUS POSEIDON MIT ALUMINIUMOXYD-ISOLATOR IM BETRIEBSBEREICH VON 280 BIS 500 KJ]
H. Herold, H. J. Kaeppeler, M. Sadowski, H. Schmidt, and M. Shakhatre Mar. 1988 19 p In GERMAN
(IPF-88-1; ETN-88-93217) Avail: NTIS HC A03/MF A01

Operational behavior of plasma focus experiment POSEIDON insulated with Al2O3 is analyzed and results indicate a net improvement. A pyrex insulator determined a reduction of neutrons production which is no more observed with Al2O3. With increasing bank energy neutron production rises. Interferometric measurements of the compressed plasma density and width are given in the time delay of -100 to -200 nsec. ESA

N89-12433# FOM-Inst. voor Plasmafysica, Rijnhuizen, Jutphaas (Netherlands).
STABILITY OF A TAYLOR-RELAXED CYLINDRICAL PLASMA SEPARATED FROM THE WALL BY A VACUUM LAYER
W. Schuurman and M. P. H. Weenink (Technische Hogeschool, Eindhoven, Netherlands) Jul. 1988 43 p
(Rept-88-177; ETN-88-93375) Avail: NTIS HC A03/MF A01

The minimum energy principle of Taylor is extended to the case where a vacuum layer is situated between the weakly resistive plasma and the perfectly conducting wall. The second variation is investigated for periodic perturbations (m and/or k not = 0) as well as for symmetric perturbations (m=k=0). A necessary and sufficient criterion for stability is derived by the Rayleigh ratio method and turns out to be identical with the result of the resistive mode analysis. Stability diagrams lambda vs k are presented. An instability region at $m=1$ is found at negative values of k, already present when lambda is small. The symmetric mode becomes more unstable as the vacuum layer grows thicker. ESA

N89-11976# Bell Telephone Labs., Inc., Holmdel, N. J.
OPTICAL READING OF InGaAs MODULATION DOPED FIELD EFFECT TRANSISTOR
I. Bar-Joseph, D. S. Chemis, C. Klingshirn, D. A. B. Miller, J. M. Kuo, and T. Y. Chang *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 213-217 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 20L

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N89-12434# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ANHARMONIC MODEL FOR HIGH-T(SUB c) SUPERCONDUCTORS
N. M. Plakida, V. L. Aksenov, and S. L. Drechsler 1987 5 p Submitted for publication
(DE88-702919; JINR-E-17-87-198) Avail: NTIS (US Sales Only) HC A02/MF A01

A considerable enhancement of the superconducting transition temperature T sub c in perovskite oxide compounds is explained in the framework of the anharmonic model for superconductors with structurally unstable lattices. It is shown that anharmonic local excitations with fluctuation amplitudes much greater than harmonic vibrations amplitudes lead to a considerable enhancement of the coupling constant lambda. The obtained estimations for T sub c are in agreement with experimental data for La(Y)BaCuO systems. DOE

N89-12435# Argonne National Lab., Ill.
TEXTURING OF RBa2Cu3O(SUB 7-x) SUPERCONDUCTORS
K. C. Goretta, A. J. Schultz, D. W. Capone, II, T. L. Tolt (Case Western Reserve Univ., Cleveland, Ohio.), U. Balachandran, J. T. Dusek, M. T. Lanagan, R. B. Poeppel, J. P. Singh, and D. Shi et al. Apr. 1988 10 p Presented at the 90th Annual Meeting of American Ceramic Society, Cincinnati, Ohio., 1-5 May 1988 Prepared in cooperation with Illinois Inst. of Tech., Chicago
(Contract W-31-109-eng-38)
(DE88-011987; CONF-880504-4) Avail: NTIS HC A02/MF A01

Ceramic superconductors have been textured mechanically in the green state during plastic extrusion and tape and slip casting. The resultant weak-to-moderate textures have been identified by X-ray and neutron diffraction as preferential alignment of c axes normal to the conductor surface. Texturing gave rise to significant increases in critical current density J(sub c), although low specimen densities or presence of second phases limited the improvements in J(sub c). DOE

N89-12436# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
DEVELOPMENT OF STANDARDS FOR SUPERCONDUCTORS Interim Report, Jan. 1986 - Dec. 1987
L. F. Goodrich Feb. 1988 85 p
(Contract DE-AI01-76PR-06010)
(PB88-215439; NBSIR-88-3088) Avail: NTIS HC A05/MF A01 CSCL 20L

A cooperative program with the Department of Energy, the National Bureau of Standards, other national laboratories, and private industry is in progress to develop standard measurement practices for use in large scale applications of superconductivity. Research is described for the period January 1986 through December 1987. It contains the results of critical current studies on the effect of power-supply current ripple, measurements on cable strands, an interlaboratory conuctor, and a Nb3SN round robin. Several useful current supply circuits were developed. The reduction in coupling losses in multifilamentary NbTi conductors was addressed by a study of the magnetic properties of matrix material consisting of dilute alloys of Mn in Cu. In addition, vibrating-sample magnetometry is shown to be adaptable to the measurement of coupling losses, in addition to hysteresis losses, in multifilamentary conductors. GRA

N89-12437# Argonne National Lab., Ill. Materials and Components Technology Div.
CERAMIC FABRICATION PROCESSES FOR HIGH-T(SUB c) SUPERCONDUCTORS
R. B. Poeppel, K. C. Goretta, M. T. Lanagan, J. T. Dusek, and J. K. Degener Mar. 1988 5 p Presented at the American Power Conference, Chicago, Ill., 17-20 Apr. 1988
(Contract W-31-109-eng-38)
(DE88-011991; CONF-880403-2) Avail: NTIS HC A02

Several ceramics are known to be superconductors above the temperature of liquid nitrogen. Conventional ceramic processing techniques can be used to fabricate each of these ceramics into useful conductors. A common and versatile means of forming monofilament conductors is to mix superconductor powder with plastics, and then form the plastic mass into the desired shape. Post-forming heat treatment burns off the plastics and yields dense final products. The constituents of the plastic mix, and the forming and firing processes used to fabricate YBa2Cu3O(sub 7-x) superconductors shall be discussed. DOE

N89-12438# Pacific Northwest Labs., Richland, Wash.
PREPARATION AND PROPERTIES OF THIN FILM HIGH-TEMPERATURE SUPERCONDUCTORS
L. R. Pederson, W. J. Weber, and G. J. Exarhos Aug. 1988 8 p Presented at the 21st Annual Technical Meeting of the International Metallographic Society, Toronto, Ontario, 26 Jul. 1988
(Contract DE-AC06-76RL-01830)
(DE88-015462; PNL-SA-15891; CONF-880790-3) Avail: NTIS HC A02/MF A01

Thin films of high-temperature superconducting materials in the Y-Ba-Cu-O system have been prepared via a novel aqueous solution route, using glycine as a complexant. A principal advantage of this route is that no precipitation occurred during initial drying steps, yielding instead a clear, glass-like material. Films were spin-coated onto SiO sub 2, Al sub 2 O sub 3, MgO, and (Y,Zr)TiO sub 3-coated SiO sub 2. Secondary ion mass spectrometry (SIMS) compositional depth profiles showed that Ba segregated to the interface of SiO sub 2 and Al Sub 2 O sub 3 substrates, which severely affected the film stoichiometry. Such problems were much less pronounced with MgO or (Y,Zr)TiO sub 3-coated SiO sub 2 substrates. While superconducting properties have not been optimized, the method holds promise for inexpensive preparation of a wide range of thin film compositions. DOE

N89-12439# California Univ., Berkeley. Lawrence Berkeley Lab.
STRUCTURAL PROPERTIES OF YBa2Cu3O(SUB 6+DELTA)
J. W. Morris, Jr. and A. G. Khachaturyan May 1988 9 p Presented at the MRS International Meeting on Advanced Materials, Tokyo, Japan, 30 May 1988
(Contract DE-AC03-76SF-00098)
(DE88-012028; LBL-25347; CONF-880529) Avail: NTIS HC A02/MF A01

The composition-wave theory of oxide structures is used to interpret the equilibrium structures of YBa2Cu3O(sub 6+ delta), predict its equilibrium phase diagram, describe the transient ordered states that are most likely to appear during decomposition, and discuss the probable transformation paths and microstructures that follow from them. The results are in reasonable agreement with experiment. DOE

N89-12440# Rochester Univ., N. Y. Dept. of Chemistry.
PICOSECOND STUDIES OF ELECTRON TRANSFER PROCESSES AT SEMICONDUCTOR INTERFACES
R. J. Dwayne Miller 1988 3 p
(Contract DE-FG02-85ER-13455)
(DE88-014667; DOE/ER-13455/2) Avail: NTIS HC A02/MF A01

To study the dynamics of surface electron transfer processes, three, highly surface specific, optical probes have been developed in conjunction with semiconductor liquid junctions: surface restricted transient gratings, optically generated surface acoustic waves, and in-situ electro-optic sampling of surface space charge fields. These three optical probes have been employed to measure interfacial carrier population dynamics, interface structure and carrier thermalization, and surface transport respectively at TiO2(001) and GaAs(100) interfaces. DOE

N89-12441# EG and G Energy Measurements, Inc., Goleta, Calif.
CORRELATION BETWEEN MERCURIC IODIDE DETECTOR PERFORMANCE AND CRYSTALLINE PERFECTION
M. Schieber, C. Ortale, L. vandenBerg, W. Schnepple, L. Keller, C. N. J. Wagner, W. Yelon, F. Ross, G. Georgeson, and F. Milstein (California Univ., Santa Barbara.) 1987 53 p Presented at the 6th International Workshop on Compound Semiconductors for Room Temperature X-Ray and Nuclear Detectors, Davos, Switzerland, 14 Sep. 1987
(Contract DE-AC08-83NV-10282)
(DE88-014958; EGG-10282-2146; CONF-8709315-9) Avail: NTIS HC A04/MF A01

An attempt has been made to establish a correlation between the results of X-ray rocking curves and X-ray reflection topographs for vapor grown HgI sub 2 single crystals. X-ray rocking curves were obtained by double crystal spectroscopy with Si as the first crystal and topographs were produced using the Berg-Barrett technique with an asymmetrically cut Si-disperser. The crystals were evaluated at different stages of detector preparation, i.e., cutting, polishing, etching, and deposition of contact. Multiple diffraction peaks could be observed as being indicative of small angle grain boundaries of up to 2 degrees. Definite nonuniformities on virgin single crystals as well as on detector crystals were observed by both methods. The crystal surface quality as assessed by these methods were used as a criterion to verify detector performance rating. No drastic improvement of surface quality on space grown crystals was indicated by these techniques. Efforts have also been devoted to determine intrinsic full width at half maximum of HgI(sub 2) crystal for the crystallographic direction studied. DOE

N89-12442# Sandia National Labs., Albuquerque, N. Mex.
OPTICAL DETECTION OF IMPURITIES AND DEFECTS IN DETECTOR-GRADE MERCURIC IODIDE VANDENBERG, L.
R. B. James, D. K. Ottesen, D. Wong, T. E. Schlesinger, W. F. Schnepple, C. Ortale, and L. vandenBerg (EG and G Energy Measurements, Inc., Goleta, Calif.) 1987 32 p Presented at the 6th International Workshop on Compound Semiconductors for Room Temperature X-Ray and Nuclear Detectors, Davos, Switzerland, 14 Sep. 1987
(Contract DE-AC08-83NV-10282)
(DE88-014959; EGG-10282-2162; CONF-8709315-10) Avail: NTIS HC A03/MF A01

Fourier tranform infrared spectroscopy (FTIR) and low-temperature photoluminescence were used to study impurities and defects in mercuric iodide crystals. FTIR spectra of the transmittance and reflectance were obtained in the 400 to 4000 cm sup minus 1 range, and the results were found to vary for different samples due to the presence of impurities and stoichiometry deviations. The photoluminescence data were found to consist primarily of three distinct emission bands. The lowest energy band at about 680 nm (at 4.2 K) was shown to be related to the performance of nuclear radiation detectors fabricated from these samples. Further correlations between the spectral features obtained from FTIR and photoluminescence techniques and the detector response are also noted. DOE

N89-12443# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
STUDY OF INFRARED NONLINEAR PROCESSES IN SEMICONDUCTORS Final Technical Report, 1 Oct. 1985 - 30 Sep. 1987
Peter A. Wolff 18 May 1988 17 p
(Grant AF-AFOSR-0269-85; AF Proj. 2305)
(AD-A196452; AFOSR-88-0596TR) Avail: NTIS HC A03/MF A01 CSCL 20L

This study of infrared nonlinear processes in semiconductors includes: (1) a demonstration that phase transitions and electrical instabilities enhance optical nonlinearities in semiconductors; (2) the discovery of exceedingly large third order optical nonlinearities cubed chi greater than 0.001 esu with picosecond response time in zero gap materials (HgTe, HgCdTe, HgMnTe); (3) the first observation of impurity-induced optical nonlinearity in semiconductors; and (4) the prediction and observation of negative absolute carrier mobilities in quantum wells. GRA

N89-12444# Stanford Univ., Calif. Electronics Lab.
PHYSICS OF METAL OVERLAYERS ON SEMICONDUCTORS Annual Report, 1 Jan. 1987 - 1 Apr. 1988
S. Doniach and I. Lindau 5 May 1988 3 p
(Contract N00014-86-K-0736)
(AD-A196471) Avail: NTIS HC A02/MF A01 CSCL 07B

A systematic kinetics study of the initial stage of band bending of metal/GaAs(110) has been done. At low temperature, independent of metals, enhanced band bending for p-GaAs and attenuated band bending for n-GaAs as a function of metal coverage has been observed. For p-type GaAs the band bending increases very rapidly to a value larger than that for any coverage at room temperature and then returns to the room temperature position at high coverages. It is found that this excess band bending strongly depends on the work functions of the metal deposited on GaAs. In gives 0.4 eV, Al 0.3 eV, Ag 0.2 eV, and Au only shows small excess band bending. The results strongly suggest that there exists another mechanism which appears to be dominant in the initial stage band bending at low temperature where the defect formation is negligible. GRA

N89-12445# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AVALANCHE CHARACTERISTICS OF SILICIDE SCHOTTKY BARRIER DIODES M.S. Thesis
Kenneth L. Yates 1988 65 p
(AD-A196474; AFIT/CI/NR-88-82) Avail: NTIS HC A04/MF A01 CSCL 20L

This thesis investigates the use of an avalanche Platinum Silicide (PtSi) Schottky Barrier Diode as a detector in fiber optic communication systems for the 1.3 to 1.5 micron spectral region. The avalanche process is used to amplify the signal prior to electrical interfacing in order to enhance the signal-to-noise ratio. The proper environment for avalanche use is when the system is pre amplifier noise limited. The amount of multiplication is predicted by the impact ionization coefficients for electrons and holes, alpha and beta, respectively. Detectors should be constructed of materials where alpha and beta differ greatly, and then the multiplication should be initiated by the carrier with the higher ionization coefficient. By using PtSi Schottky diodes, where alpha is greater than beta, pure electron injection can be accomplished by irradiating with photons of energy psi less than Hnu less than Eg (where psi is the Schottky Barrier height and Eg is the bandgap of silicon), thus maximizing multiplication and minimizing noise. Experimental results on the PtSi diodes studied showed high dark currents at room temperature and premature reverse breakdown which prevented multiplication. However, values from previous reported results allow us to predict a multiplication of 68 with an excess-noise factor of 11.1, an NEP of 2.5 x 10 to the minus 8th power watts, and finally a gain-bandwidth product of 242 GHz. GRA

N89-12446# Naval Postgraduate School, Monterey, Calif.
TRANSISTOR SIZING IN THE DESIGN OF HIGH-SPEED CMOS (COMPLEMENTARY-SYMMETRY METAL-OXIDE-SEMICONDUCTOR) SUPER BUFFERS M.S. Thesis
Gordon R. Steele Mar. 1988 145 p
(AD-A196526) Avail: NTIS HC A07/MF A01 CSCL 20L

An algorithm for sizing transistors for static Complementary-symmetry Metal-Oxide-Semiconductor (CMOS) integrated circuit logic design using silicon gate enhancement mode Field-Effect Transistors (FET) is derived and implemented in software. The algorithm is applied to the mask level hardware design of a three micron minimum feature size p-well high-speed super buffer. A software representation of the super buffer can be used for the automated design of custom Very-Large-Scale Integrated (VLSI) circuits. GRA

N89-12447# Cambridge Univ. (England).
QUANTUM PHENOMENA IN SEMICONDUCTOR STRUCTURES Annual Report No. 1, Oct. 1985 - Oct. 1986; Interim Report No. 4-6, Oct. 1986 - Apr. 1988
M. Pepper Apr. 1988 54 p
(Contract DAJA45-85-C-0045)
(AD-A196605; R/D-5180-EE-01) Avail: NTIS HC A04/MF A01 CSCL 20L

Experiments are done to produce a metal pattern on the AlGaAs of an AlGaAs-GaAs modulation doped heterojunction. This will enable us to investigate details of the transport when the effective sample length is considerably less than the scattering mean free path. Many of the proposed experiments of this grant concern 1-D effects and we have concentrated (during this last period) on the energy levels in narrow modulation doped electron channels in AlGaAs-GaAs heterojunctions. Previously we demonstrated the existence of disorder-induced, one-dimensional conductivity corrections in a narrow-channel electron gas within a split-gate GaAs:AlGaAs heterojunction field-effect transistor. At temperatures such that the phase-relaxation (inelastic) length and the interaction length are greater than the channel width, the quantum corrections to the conductivity become one-dimensional. We have now investigated the effects of a large, transverse, magnetic field on the conductivity when the channel is narrow. A WKB calculation was performed which shows that a magnetic-field-induced depopulation of the 1-D subbands occurs. The mobility in thi system is much higher than in other quasi 1-D systems so that lifetime broadening of electronic subbands subbands approximately equal Tau is sufficiently small for subband depopulation to be directly observed as structure in the magnetoconductance. Here Tau is the elastic lifetime. GRA

N89-12448# Atom Sciences, Inc., Oak Ridge, Tenn.
TRACE ELEMENT CHARACTERIZATION IN 3-5 COMPOUNDS SPUTTER BY SPUTTER INITIATED RESONANCE IONIZATION SPECTROSCOPY Final Report, Jul. - Dec. 1986
James E. Parks Apr. 1988 47 p
(Contract F19628-86-C-0123)
(AD-A196659; RADC-TR-88-53) Avail: NTIS HC A03/MF A01 CSCL 07B

The VLSI and VHSIC development programs of the Air Force require characterization of 3-5 compounds with an interference free, highly sensitive element analysis technique having good lateral depth resolution. Sputter Initiated Resonance Ionization Spectroscopy (SIRIS), an ultrasensitive analytical technique being developed commercially by Atom Sciences, has been demonstrated to have good sensitivity and to be interference free in silicon. Detection limits of 2 ppb (1 x 10 to the 14th/cc) have been shown for gallium in bulk silicon. Prior to the work reported here, lateral and depth resolution of the SIRIS apparatus was not adequate for the present and future needs of the semiconductor industry. Lateral resolutions of 100 to 5 microns are now necessary, and resolutions into the submicron range will be required in the future. In the project reported here, the SIRIS instrument was modified to include a microbeam ion gun system, and the new instrument was demonstrated to have a lateral resolution less than 100 microns with a detection limit in the few ppb range. An ion beam of about 5 microns diameter was demonstrated with a predicted limit of 0.1 to 1 ppm. GRA

N89-12449# Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
POINT DEFECTS IN SEMICONDUCTORS: MICROSCOPIC IDENTIFICATION, METASTABLE PROPERTIES, DEFECT MIGRATION, AND DIFFUSION Annual Report, 31 Aug. 1986 - 29 Feb. 1988
James A. VanVechten and John F. Wager 22 Apr. 1988 5 p
(Grant AF-AFOSR-0309-86; AF Proj. 2306)
(AD-A196670; AFOSR-88-0668TR) Avail: NTIS HC A02/MF A01 CSCL 20L

Fundamental progress is made in the identification of point defect complexes in semiconductors (particularly EL2 and ELO in GaAs), the elucidation of the mechanisms by which they migrate (particularly re vacancy nearest neighbor hopping in compound semiconductors and recombination enhanced migration of vacancies in Si), and the development of an efficient means to simulate their detailed, and very complicated, diffusion and inter-reaction on a microcomputer using an innovative (and evidently unique) Monte Carlo method. Some effort has also recently gone into the elucidation of the temperature dependence of band off sets at heterojunctions, particularly GaAs-AlAs and HgTe-CdTe. GRA

N89-12450# Wales Univ. Inst. of Science and Technology, Cardiff. Dept. of Physics Electronics/Electrical Engineering.
OPTIMISATION OF THE THERMOELECTRIC FIGURE OF MERIT OF MODIFIED SILICON GERMANIUM ALLOYS Interim Report No. 2
D. M. Rowe May 1988 9 p
(Contract DAJA45-87-C-0048)
(AD-A196673; R/D-5857-PH.01) Avail: NTIS HC A02/MF A01 CSCL 20L

In this report a working theoretical model for the power factor (alpha squared sigma) of silicon germanium alloys is presented and the dependence of this parameter on carrier concentration and number of valleys explored. Although silicon-germanium alloys cannot be described as narrow band gap semiconductors, the high level of doping employed in thermoelectric applications necessitates the inclusion in the theoretical model of deviations from the usually assumed parabolic bands. The dependence of the Seebeck coefficient (alpha), electrical conductivity (sigma) and the power factor (alpha squared sigma) on carrier concentration and number of valleys N sub v are presented. Two main conclusions can be drawn from the reported results. A large number of equi-energetic valleys give rise to a higher power factor at room temperature, when intervalley scattering can be considered negligibly small. Higher doping levels are required in order to take advantage of the large number of valleys. GRA

N89-12451# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE ION-ASSISTED DEPOSITION OF OPTICAL THIN FILMS Ph.D. Thesis
James D. Targove 1988 215 p
(AD-A196876; AFIT/CI/NR-88-57) Avail: NTIS HC A10/MF A01 CSCL 07B

The columnar microstructure of most thermally evaporated thin films detrimentally affects many of their properties through a reduction in packing density. In this work, we have investigated ion-assisted deposition as a means of disrupting this columnar growth for a number of coating materials. A Kaufman hot-cathode ion source bombarded thermally evaporated films with low-energy (less than 1000 eV) positive ions during deposition in a cryopumped box coater. We have investigated MgF2, Na3AlF6, AlF3, LaF3, CeF3, NdF3, Al2O3, and AlN. Argon ion bombardment of the fluoride coatings increased their packing densities dramatically. We achieved packing densities near unity without significant absorption for MgF2, LaF3, and NdF3, while Na3AlF6, AlF3, and CeF3 began to absorb before unity packing density could be achieved. Fluorine was preferentially sputtered by the ion bombardment, creating anion vacancies. The films adsorbed water vapor and hydroxyl radicals from the residual chamber atmosphere. These filled the vacancy sites, eliminating absorption in the visible, but the oxygen complexes caused increased absorption in the ultraviolet. For LaF3 and NdF3, a sufficient amount of oxygen caused a phase transformation from the fluoride phase to an oxyfluoride phase. GRA

N89-12452# State Univ. of New York, Buffalo. Dept. of Chemistry.

ANALYSIS OF THERMODYNAMIC AND TRANSPORT PROPERTIES OF La(2-x)M(x)CuO4 AND YBa2Cu3O(7 - DELTA) SUPERCONDUCTORS

A. Langner, D. Sahu, and Thomas F. George Jun. 1988 18 p
Submitted for publication
(Contract N00014-86-K-0043)
(AD-A196955; UBUFFALO/DC/88/TR-72) Avail: NTIS HC A03/MF A01 CSCL 20C

Anisotropic Ginzburg-Landau theory for coupled s-wave and d-wave order parameters is used to analyze the unique thermodynamic and transport properties of the new La2-x(Ba,Sr)xCuO4 and YBa2Cu3O7-delta superconductors. This simple phenomenological approach is used to explain the prevalence of the large Sommerfeld coefficients of the specific heat, the existence of multiple specific heat anomalies, the ultrasonic attenuation peak, and model the anisotropic critical field data as observed in oriented samples. GRA

N89-12453# Michigan State Univ., East Lansing. Membrane Biophysics Lab.

ELECTROCHEMISTRY OF BILAYER LIPID MEMBRANES Annual Report, 16 Jun. 1987 - 15 Jun. 1988

H. T. Tien 16 Jun. 1988 5 p
(Contract N00014-85-K-0399; Proj. RR0-4108)
(AD-A197017) Avail: NTIS HC A02/MF A01 CSCL 07C

The main objective will be to understand the mechanism of charge generation, separation and transport in electron-conducting bilayer lipid membranes in which one side of the membrane is a cathode and the other is an anode. Our approach may be thought of as a unique way to investigate the diode effect of a molecular junction free from the usual bulk solid effects. Currently available conducting polymers and a variety of novel compounds to be synthesized will be incorporated into these ultrathin lipid films for study. The electrical and photoelectrical properties of these ultrathin films separating two aqueous solutions will be investigated by but not limited to, photoelectrospectrometry and cyclic voltammetry recently developed and applied by our laboratory to membrane and ultrathin film research. GRA

N89-12454# North Carolina State Univ., Raleigh.

SYNTHESIS AND PROPERTIES OF CdTe FILMS Final Report, 1 Mar. 1984 - 30 Sep. 1987

J. F. Schetzina 20 Jun. 1988 22 p
(Contract DAAG29-84-K-0039)
(AD-A197041; ARO-21295.1-EL) Avail: NTIS HC A03/MF A01 CSCL 07B

This program of research was established to develop CdTe epitaxial films and quantum well structures by molecular beam epitaxy (MBE) and to study their physical properties. During 1983 to 1985, CdTe films were successfully deposited on various substrates including sapphire, silicon, and gallium arsenide. The films were judged to be of high quality on the basis of photoluminescence and X-ray diffraction rocking curve studies. Using the photoassisted MBE technique to prepare n-type CdTe and CdMnTe layers led to the fabrication of field effect transistors based on these materials. The present program has impacted profoundly on the development of the II-VI semiconductors studied and has contributed significantly to a strong resurgence of interest in these materials. The work impacts on the areas of optoelectronics, magnetooptics, integrated optics and infrared detector technology. GRA

N89-12455# Pacific Northwest Labs., Richland, Wash.

PROCESSING AND CHARACTERIZATION OF MONOLITHIC HIGH-TEMPERATURE SUPERCONDUCTORS

William J. Weber and Larry R. Pederson Mar. 1988 9 p
Presented at the SAMPE Electronic Materials and Processes Conference, Seattle, Wash., 14 Jun. 1988
(Contract DE-AC06-76RL-01830)
(DE88-014763; PNL-SA-15807; CONF-880690-2) Avail: NTIS HC A02

Powders of high-temperature superconducting materials in the Y-Ba-Cu-O, Bi-Sr-Ca-Cu-O, and Tl-Ba-Ca-Cu-O systems have been prepared by solid-state reaction techniques. Monolithic samples of these materials have been produced by both sintering and plasma-spraying techniques. Controlled oxygen annealing is generally required to optimize the superconducting properties. These monolithic materials exhibit superconducting transition temperatures that exceed 80 K, with the highest observed transition temperature (105 K) in the Tl-Ba-Ca-Cu-O system. The measured critical current densities are low, however, due to the presence of weak links in the form of grain-boundary material and microcracks. DOE

N89-12456# Illinois Univ., Urbana. Materials Research Lab.

PREPARATION OF YBa2Cu3O/SUB 7-DELTA/ FROM HOMOGENEOUS METAL ALKOXIDE SOLUTION

W. G. Fahrenholtz, D. M. Millar, and D. A. Payne 1988 7 p
Presented at the Superconductor Symposium, Cincinnati, Ohio, 1 May 1988
(Contract DE-AC02-76ER-01198)
(DE88-015272; DOE/ER-01198/T30; CONF-8805123-2) Avail: NTIS HC A02/MF A01

Reactive, homogeneous 1:2:3 Y:Ba:Cu solutions, were prepared in 2-methoxyethanol, by reaction of Y(OCH2CH2OCH3)3, Ba(OCH2CH2OCH3)2, and a soluble copper alkoxide. The general insolubility of copper (2) alkoxides was circumvented by synthesizing the mixed-ligand species (C5H7O2)2Cu2(mu-OCH2-CH2OCH3)2. Powders and thin layers were prepared. Data are reported for the chemical preparation method and material characteristics, as determined by x-ray diffraction, differential thermal analysis, and infrared spectroscopy. DOE

N89-12457# Oak Ridge National Lab., Tenn. Solid State Div.

EVALUATION OF NEW METAL-INSULATOR-SEMICONDUCTOR VARISTOR Final Report

F. A. Modine Aug. 1988 33 p
(Contract DE-AC05-84OR-21400)
(DE88-015708; ORNL/TM-10886) Avail: NTIS HC A03/MF A01

A new, composite varistor material containing a metal, an insulator, and a semiconductor was evaluated. Although other constituents can be substituted, the materials that were investigated contained varying proportions of nickel metal, silicon dioxide, and silicon carbide in a silicon rubber binder. The material has rubber-like flexibility and is easily formed into complex shapes. A higher leakage resistivity (approximately 10 to the 12th power ohm cm) and greater nonlinearity (approximately 10) than for commercial silicon carbide varistors will permit the material to be used as a gapless surge suppressor. The breakdown voltage (1 kV/cm-10 kV/cm) and other properties of the material vary with composition. High-current capability (greater than 200 A/square cm) and good energy absorption (greater than 40 J/cubic cm) are found. The material exhibits a low-temperature coefficient (approximately 4 x 10 to the minus 3rd power) and a low dielectric constant (approximately 10) with no observed loss peak. These dielectric properties are suited to high-frequency applications, such as antenna protection. The material has a response time (less than 1 ns) that should provide some protection against fast pulses generated by nuclear and directed-beam weapons. At this stage, the physics of the material are mostly conjecture, but the electrical conduction is almost certainly controlled by grain-boundary barriers. DOE

N89-12458# California Univ., Berkeley. Lawrence Berkeley Lab.
THE CRYOGENIC SYSTEMS FOR THE ASTROMAG TEST COIL
M. A. Green, S. M. Levin, G. F. Smoot, and C. Witebsky Jul. 1988 5 p Presented at the 12th International Cryogenic Engineering Conference and Exhibition, Southhampton, United Kingdom, 12 Jul. 1988
(Contract DE-AC03-76SF-00098)
(DE88-016633; LBL-25732; CONF-880736-2) Avail: NTIS HC A02/MF A01

This paper describes an all helium, low heat leak cryogenic system for the testing of a superconducting magnet coil for the ASTROMAG particle astrophysics experiment. The superconducting coil, which is projected to have a stored magnetic energy of 4 to 7 MJ, will be cooled by pumped helium from a liquid helium storage tank using a fountain effect helium II pump. The pumping system can be used to cool the cryogenic system down as well as keep the coil cold during its superconducting operation. The integration of retractable 900 A gas-cooled electrical leads with the intermediate shields and intercepts is discussed. DOE

N89-12459# California Univ., Berkeley. Lawrence Berkeley Lab. Center for Advanced Materials.
PRESSURE DEPENDENCE OF SCHOTTKY BARRIER HEIGHT AT Pt/GaAs INTERFACE
W. Shan, M. F. Li, P. Y. Yu, W. Walukiewicz, and W. L. Hansen Aug. 1988 7 p Presented at the 15th International Conference on Defects in Semiconductors, Budapest, Hungary, 22 Aug. 1988
(Contract DE-AC03-76SF-00098)
(DE88-016644; LBL-25691; CONF-8808106-1) Avail: NTIS HC A02/MF A01

The pressure dependence of Schottky barrier height at the Pt/GaAs interface has been studied using a diamond anvil cell. The pressure coefficient of the Schottky barrier height suggests that whatever states responsible for the Fermi level pinning follow the valence band edge under pressure. Within models that simple intrinsic defects are responsible for the formation of Schottky barriers in GaAs, our results suggest that these intrinsic defects may involve vacancies. DOE

N89-12460# State Univ. of New York, Buffalo. Dept. of Electrical and Computer Engineering.
EPITAXIAL 3-5 SEMICONDUCTORS FOR INTEGRATED ELECTRO-OPTICS Final Report, 1 Aug. 1986 - 30 Apr. 1988
Wayne A. Anderson, O. T. Beachley, Jr., H. S. Kwok, P. L. Liu, and C. R. Wie 14 Jun. 1988 27 p
(Contract N00014-86-K-0622)
(AD-A197529) Avail: NTIS HC A03/MF A01 CSCL 20L

Research has been conducted on the synthesis and evaluation of new organometallics (OM), growth of epitaxial layers by OMCVD and laser chemical vapor deposition (LCVD), laser interaction with materials, structural and chemical evaluation of epitaxial layers, electrical evaluation of epitaxial layers and radiation effects in semiconductors and insulators. New OM precursors were developed and used in OMCVD. New OM sources are considered for lower toxicity and more efficient reaction. For the first time, InSb was grown in CdTe by OMCVD. A quadrupole mass analyzer and low temperature luminescence were installed for in situ diagnostics. Laser interaction studies reveal the importance of tunneling ionization for carrier generation in low bandgap materials. Ion emission has been measured from a metal surface due to laser irradiation. Ions were observed at low laser fluence and at a frequency corresponding to an energy less than the material work function. Rocking curve studies of MBE-grown strained GaInAs on GaAs is the most reliable technique for strains less than 0.3 percent. LO-TO splitting in ion damaged GaAs has been explained by the effective ionic charge of the ion beam-induced point defects. Deep level transient spectroscopy studies of irradiated p-InP has revealed trap levels and annealing effects of importance in extraterrestrial applications. A Yb/p-InP device has shown good linearity and improved stability as a temperature sensor from 100 to 400K. GRA

N89-12461# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
COMPOUND SEMICONDUCTOR MATERIALS, DEVICES AND CIRCUITS Annual Report, 1 May 1987 - 30 Apr. 1988
J. R. Shealy, L. F. Eastman, E. D. Wolf, P. J. Tasker, and J. P. Krusius Jun. 1988 62 p
(Contract F49620-87-C-0044)
(AD-A197640; AFOSR-88-0738TR) Avail: NTIS HC A04/MF A01 CSCL 09A

This one year research program on compound semiconductor materials growth, devices and circuits has focused on: (1) organometallic vapor phase epitaxy (OMVPE) of GaInP/GaAs and AlInP/GaInP superlattices; (2) enhancement of heterostructure device speed performance via strain layer superlattices and mushroom gates in modulation doped FET's (MODFET's), and inserted tunnel barriers heterojunction bipolar devices (HBT); (3) fabrication and characterization of MODFET devices with gate lengths to 50 nm; (4) self-consistent Monte Carlo transport formulation and its application to small graded heterostructure devices; (5) optical modulation based on the quantum confined Stark effect; and (6) femtosecond spectroscopy of hot carrier processes using the visible Rh6G laser and a new UV BaB2O4 laser. GRA

N89-12462# Texas Univ., Austin. Dept. of Physics.
TUNNELING MICROSCOPY OF SUPERCONDUCTORS AND TUNNELING BARRIERS Annual Report, 1 Jun. 1987 - 31 May 1988
Alex DeLozanne 31 May 1988 11 p
(Grant AF-AFOSR-0228-87; AF Proj. 2306)
(AD-A197686; AFOSR-88-0705TR) Avail: NTIS HC A03/MF A01 CSCL 20C

Thin films of high temperature superconductors were made by sputtering and by co-evaporation. The former method produced thin films of YBaCuO which were completely superconducting at 82 K with 6 K transition widths. A new method was developed at the University of Texas which produced films of YBaCuO on strontium titanate that were superconducting at 84 K. This method minimizes the process temperature and produces films which are superconducting without the need for annealing. The films were also grown on silicon and sapphire substrates with zero resistance of 68 K or better. A low temperature scanning tunneling microscope was used to study the superconducting properties of these and other samples. High quality spectroscopic data was obtained which yields a value of approximately 11 for the ratio of the superconducting gap to the transition temperature. GRA

N89-12463# California Univ., Santa Barbara. Dept. of Electrical and Computer Engineering.
RESEARCH OF MBE GROWTH AND PROPERTIES OF SEMICONDUCTORS HETERO-INTERFACES WITH UNUSUAL BAND LINEUPS Final Report, Sep. 1985 - Mar. 1988
Herbert Kroemer 19 Sep. 1987 10 p
(Contract N00014-85-K-0669)
(AD-A197728) Avail: NTIS HC A02/MF A01 CSCL 20L

A wide diversity of topics related to various new properties of semiconductor heterostructures was investigated: (1) Staggered-lineup luminescence; (2) Band offsets at lattice-matched (Ga,In) P/GaAs heterojunctions; (3) Optical properties of GaSb/AlSb multi-quantum well structures; (4) Growth of InAs/GaSb broken-gap heterojunctions; (5) Alternating-beam MBE; (6) Tilted super-lattices; and (7) Schottky barriers between metals and semiconducting polymers. The determination of the band lineups at the (Ga,In) P/GaAs heterojunction, and the achievement of tilted super-lattices by alternating-beam MBE were probably the most significant of these developments. The latter of these two forms the core of research under an ongoing follow-up contract. GRA

N89-12464# Marconi Electronic Devices Ltd., Lincoln (England).
THREE MICRON SILICON-ON-SAPPHIRE TECHNOLOGY EVALUATION PROGRAMME
D. Wootten Paris, France ESA Jan. 1988 177 p

(Contract ESA-6579/86-NL-IW)
(IC-DOC-57; ESA-CR(P)-2644; ETN-88-93173) Copyright Avail: NTIS HC A09/MF A01

CellSOS, a standard design and manufacturable route used to produce radiation hardened SOS integrated circuits was evaluated. Single event upset (SEU) and total-dose aspects of radiation with extended life test data were considered. Worst case bias during irradiation for SOS RAMs is with 5V on VDD and inputs held high. The parameter with the major movement with radiation is standby current; no other parameter shows significant change with accumulated dose. The functional failure point of both RAMs with radiation is caused by this increase in current and not by the Vt shift preventing correct transistor operation. Life testing of irradiated and nonirradiated devices shows very little movement in parametrics over the 2000 hr except for standby current. The ability of the 3 micron SOS cell and SLM gate array products to maintain functionality and acceptable performance characteristic to total dose gamma radiation levels exceeding 1MRad (Si) is proved. The 3 micron SOS process has very good immunity to SEU within the space environment. Tests on the 4K RAM confirm that there is no latch-up mechanism present in SOS. The results also demonstrate that, provided the six transistors cell and layout is used for all 3 micron SOS RAMs, similar upset rates will be achieved. ESA

N89-12465# Ecole Centrale de Lyon (France). Lab. d'Electronique, Automatique et Mesures Electriques.
STUDY AND MODELING OF ENERGETIC CARRIER INJECTION IN THE INSULATOR OF MIS STRUCTURES Ph.D. Thesis [ETUDE ET MODELISATION DE L'INJECTION DE PORTEURS ENERGETIQUES DANS L'ISOLANT DES STRUCTURES MIS]
Fahed Chehade 1988 173 p In FRENCH Sponsored by the Fondation HARIRI
(ECL-88-06; ETN-88-93257) Avail: NTIS HC A08/MF A01

Measurement of semiconductor devices of silicon on sapphire type were made in order to identify the parameters affected by carrier injection, in the frame of VLSI development. Electron-hole pairs were created optically in the silicon substrate with enough energy to be injected in the insulator. The current injected is determined by indirect methods. The results are analyzed following the Shockley method. The study allows the estimation of the current intensity injected in a normally functioning transistor, and the voltage limit over which hot carrier injection takes place. ESA

N89-12466# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
STUDY AND DEVELOPMENT OF A SOFTWARE TO SIMULATE HETEROEPITAXIAL CRYSTAL GROWTH Ph.D. Thesis - Toulouse Univ.
Abdelouahab Amrani 1988 183 p In FRENCH; ENGLISH summary
(LAAS-88-199; ETN-88-93288) Avail: NTIS HC A09/MF A01

Monte Carlo techniques were associated to molecular mechanics in order to take stress effects into account, and to simulate defect creation. The stress energy is limited to its bending part, which represents the most significant contribution to the total energy. A first version of a simulation program is available. Its capabilities include atomic displacements in the substrate as a consequence of stress relaxation on the surface, defect creation and annihilation, surface configuration, and spatial distribution of the stress. ESA

N89-12467# Royal Signals and Radar Establishment, Malvern (England).
PRACTICAL CUSTOM CMOS CHIP DESIGN
T. I. Browning May 1988 19 p
(RSRE-Memo-4143; BR106724; ETN-88-93553) Copyright
Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

Custom chip design steps are outlined, emphasizing practical aspects involved in translating circuit ideas to working silicon. Shared-wafer silicon services reduce significantly the cost of full-custom chips and practical experiences of full custom CMOS chip design are discussed. The design, simulation, and layout were undertaken as part of a research program on cell architectures for VLSI chip design. ESA

N89-12468# Royal Signals and Radar Establishment, Malvern (England).
ION IMPLANTED GaAs MICROWAVE FET'S
S. S. Gill, E. G. Blockley, J. R. Dawsey, B. J. Foreman, J. Woodward, G. Ball, S. J. Beard, J. M. Gaskell, and M. B. Allenson Jun. 1988 74 p
(RSRE-Memo-4164; BR107013; ETN-88-93556) Copyright
Avail: Defence Research Information Centre, 65 Brown Street, Glasgow G2 8EX, Scotland

The combination of ion implantation and photolithographic patterning techniques was applied to the fabrication of GaAs microwave FETs to provide a large number of devices having consistently predictable dc and high frequency characteristics. To validate the accuracy and repeatability of the high frequency device parameters, an X-band microwave circuit was designed and realized. The performance of this circuit, a buffered amplifier, is very close to the design specification. The availability of a large number of reproducible, well-characterized transistors enabled work to commence on the development of a large signal model for FETs. Work in this area is also described. ESA

N89-11812# Joint Publications Research Service, Arlington, Va.
CRYSTALS: NEW SCIENTIFIC DISCOVERY
R. Akhmetov *In its* JPRS Report: Science and Technology. USSR: Materials Science 25 Apr. 1988 p 23-24 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 30 Oct. 1987 p 2 (For primary document see N89-11810 03-23)
Avail: NTIS HC A03/MF A01

N89-11979# Bell Telephone Labs., Inc., Murray Hill, N. J.
A NEW 10 MICROMETER INFRARED DETECTOR USING INTERSUBBAND ABSORPTION IN RESONANT TUNNELLING GaAlAs SUPERLATTICES
B. F. Levine, K. K. Choi, C. G. Bethea, J. Walker, and R. J. Malik *In* Optical Society of America, Topical Meeting on Picosecond Electronics and Optoelectronics 10 Oct. 1987 p 223-224 Previously announced in IAA as A87-39157 (For primary document see N89-11971 03-33)
Avail: NTIS HC A03/MF A01 CSCL 20L

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N89-12469 Purdue Univ., West Lafayette, Ind.
REANALYSIS OF THE EOTVOS EXPERIMENT Ph.D. Thesis
Carrick L. Talmadge 1987 218 p
Avail: Univ. Microfilms Order No. DA8807679

The reanalysis of the experiment of Eotvos, Pekar, and Fekete (EPF) are presented. After outlining the original motivation for reexamining the EPF paper, the history of this experiment is reviewed in some detail. A phenomenological framework is developed for describing the EPF and other similar experiments, and this is then applied to analyzing the EPF data. It is shown that these data evidence a strong correlation between the measured fractional acceleration differences of various sample pairs of materials, and the corresponding differences of baryon number-to-mass ratios. Such a correlation can result from a coupling of the test masses to an intermediate-range field whose source is baryon number, and it is shown that the properties of this field which emerge from the geophysical data provide a good description of the EPF results. It is further demonstrated that no other known mechanism, either conventional or otherwise, provides an adequate explanation of these data. Various experiments to check the EPF results are described, and a general overview of the various classes of experiments is given. In Appendix A the effects of local mass inhomogeneities are analyzed, which appear to represent the dominant sources in Eotvos-like experiments, and in the other Appendices more detailed discussions of the various aspects of this analysis are given. Dissert. Abstr.

N89-12470# International Centre for Theoretical Physics, Trieste (Italy).
ON THE INFINITIES OF CLOSED SUPERSTRING AMPLITUDES
A. Restuccia and J. G. Taylor Dec. 1987 13 p Submitted for publication
(DE88-703006; IC-87/396) Avail: NTIS (US Sales Only) HC A03/MF A01

We present an analysis of possible infinities that may be present in uncompactified multi-loop heterotic and type II superstring amplitudes constructed, without use of the short-string limit, in the light-cone gauge, and with use of a closed SUSY field theory algebra. Various types of degenerations of the integrand are discussed on the string world-sheet. No infinities are found, modulo (for type II) a particular identity for Green's functions. DOE

N89-12471 Nottingham Univ. (England).
NUMERICAL OPTIMISATION TECHNIQUES APPLIED TO PROBLEMS IN CONTINUUM MECHANICS Ph.D. Thesis
Richard Jones 1987 345 p
Avail: Univ. Microfilms Order No. BRD-80502

Numerical optimization techniques are applied to problems in continuum mechanics. The problem of minimizing the loss in total pressure generated when a fluid is forced under pressure through a cascade of airfoils within a turbo-machine is examined. Only two-dimensional airfoil sections are considered and the loss in total pressure is assumed to occur only within the viscous boundary layers on the airfoil surfaces. An inverse approach was adopted whereby an optimized surface velocity distribution is found, from which the corresponding airfoil geometry is then calculated. The performance of different optimization methods were assessed, the most successful one for this particular problem proving to be the prototype method. Numerical optimization techniques were used to solve problems in finite elasticity. The deformations are large and hence the problems themselves become geometrically nonlinear as the stiffness of the deforming body changes. Using a finite element approximation to the appropriate variational principle, solutions to plane strain problems in which the material is compressible and isotropic are considered. Using linear triangular elements, the buckled and barrelled states of a plate under compression are investigated together with the indentation of a body by a flat-ended punch. Dissert. Abstr.

N89-12472# Gosudarstvennyj Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
RELATIVISTIC THEORY OF GRAVITATION AND ITS CONSEQUENCES
A. A. Logunov, Yu. M. Loskutov, and M. A. Mestvirishvili 1987 40 p In RUSSIAN; ENGLISH summary
(DE88-702861; IFVE-OTF-87-98) Avail: NTIS (US Sales Only) HC A03/MF A01

The paper gives a brief critical analysis of General Relativity Theory (GRT). It is shown that the theory, if accepted, leads to repudiation of a number of fundamental principles underlying physics. It expounds Relativistic Theory of Gravitation (RTG) in which the gravitational field possesses all the attributes of physical fields and which is consistent completely with the fundamental physical principles as well as with the experimental and observational facts available. It also considers the consequences of RTG dealing, in particular, with the development of collapse and Universe evolution. DOE

N89-12473# Florida Univ., Gainesville. Dept. of Physics.
LECTURES ON STRING THEORY
Charles B. Thorn 1988 41 p Presented at the Spring School on Superstrings, Trieste, Italy, 1 Apr. 1988
(Contract DE-FG05-86ER-40272)
(DE88-014736; DOE/ER-40272/58; UFTP-88-7; CONF-8804173-1) Avail: NTIS HC A03/MF A01

Several topics are discussed in string theory presented as three lectures to the Spring School on Superstrings at Trieste, Italy, in April 1988. The first lecture is devoted to some general aspects of conformal invariance and duality. The second sketches methods for carrying out perturbative calculations in string field theory. The final lecture presents an alternative lattice approach to a nonperturbative formulation of the sum over world surfaces. DOE

N89-12474*# Fermi National Accelerator Lab., Batavia, Ill.
EFFECTS OF ORDINARY AND SUPERCONDUCTING COSMIC STRINGS ON PRIMORDIAL NUCLEOSYNTHESIS
Hardy M. Hodges (Chicago Univ., Ill.) and Michael S. Turner 24 Aug. 1988 22 p Sponsored in part by NASA, and DOE
(NASA-CR-183366; NAS 1.26:183366; FERMILAB-Pub-88/115-A) Avail: NTIS HC A03/MF A01 CSCL 20C

A precise calculation is done of the primordial nucleosynthesis constraint on the energy per length of ordinary and superconducting cosmic strings. A general formula is provided for the constraint on the string tension for ordinary strings. Using the current values for the various parameters that describe the evolution of loops, the constraint for ordinary strings is G mu less than 2.2 x 10 to the minus 5 power. Our constraint is weaker than previously quoted limits by a factor of approximately 5. For superconducting loops, with currents generated by primordial magnetic fields, the constraint can be less or more stringent than this limit, depending on the strength of the magnetic field. It is also found in this case that there is a negligible amount of entropy production if the electromagnetic radiation from strings thermalizes with the radiation background. Author

N89-12475# Argonne National Lab., Ill. Materials Science Div.
MOLECULAR DYNAMICS SIMULATIONS OF CLASSICAL AND QUANTUM SYSTEMS
Rajiv K. Kalia and Priya Vashishta Mar. 1988 16 p Presented at the Advanced International School on Statistical Physics, Chandigarh, India, 28 Sep. 1987
(Contract W-31-109-eng-38)
(DE88-011992; CONF-8709328-1) Avail: NTIS HC A03/MF A01

We survey the recent advances in the simulation of classical and quantum systems by the method of molecular dynamics. DOE

N89-12476# California Univ., Berkeley. Lawrence Berkeley Lab. Physics Div.
LOW-ENERGY STRUCTURE OF FOUR-DIMENSIONAL SUPERSTRINGS
F. Zwirner May 1988 9 p Presented at the 23rd Rencontre de Moriond Conference: Electroweak Interactions and Unified Theories, Les Arcs, France, 6 Mar. 1988
(Contract DE-AC03-76SF-00098)
(DE88-016648; LBL-25278; UCB-PTH-88/12; CONF-8803109-7) Avail: NTIS HC A02/MF A01

The $N = 1$, $d = 4$ supergravity theories derived as the low-energy limit of four-dimensional superstrings are discussed, focusing on the properties of their effective potentials. Gauge symmetry breaking is possible along several flat directions. A class of superpotential modifications is introduced, which describes supersymmetry breaking with vanishing cosmological constant and $\mathrm{Str}\, M^2 = 0$ at any minimum of the tree level potential. Under more restrictive assumptions, there are minima with broken supersymmetry at which also $\mathrm{Str}\, f(M^2) = 0$ for any function f, so that the whole one-loop cosmological constant vanishes. This result is interpreted in terms of a new discrete boson-fermion symmetry, relating particles whose helicities differ by 3/2, e.g., the graviton and the dilatino. DOE

N89-12477# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
AREAL MODELS OF RELATIVISTIC SPACE-FINITE OBJECTS
N. S. Shavokhina 1987 6 p In RUSSIAN; ENGLISH summary
(DE88-703397; JINR-R-2-87-716) Avail: NTIS (US Sales Only) HC A02/MF A01

In the Poincare-Minkowski space-time, all possible objects are presented, spatial cross sections of which are geometrical figures of finite dimensions and which are mathematically modelled by means of the metric concepts of space-time, such as the length of a line, the area of surfaces of two and three dimensions, and the volume of the space-time itself. All the above-listed areal objects are described by the boundary-value problem for minimal surfaces of various dimensions. DOE

N89-12478# Max-Planck-Inst. fuer Quantenoptik, Garching (West Germany).
[ACTIVITIES REPORT IN QUANTUM OPTICS] Annual Report, 1987 [JAHRESBERICHT 1987]
Mar. 1988 270 p Partly in ENGLISH and GERMAN
(ISSN-0177-0101; ETN-88-93214) Avail: NTIS HC A12/MF A01

High power lasers for the production of hot and dense plasmas for laser fusion; laser physics study of the radiation-atom interaction in the one-atom maser and with a single ion stored in a radio-frequency trap; gravitational wave detection from stellar catastrophics by a large laser interferometer (30 m); theoretical quantum optics including quantum mechanics and electrodynamics; laser chemistry applied to monitor and control laser molecular and chemical interactions; and high resolution laser spectroscopy dealing with simple atomic systems such as atomic hydrogen are discussed. ESA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N89-12479*# National Aeronautics and Space Administration, Washington, D.C.
ISSUES IN NASA PROGRAM AND PROJECT MANAGEMENT
Francis T. Hoban, ed. Oct. 1988 51 p
(NASA-SP-6101; NAS 1.21:6101) Avail: NTIS HC A04/MF A01 CSCL 05A

This collection of papers and resources on aerospace management issues is inspired by a desire to benefit from the lessons learned from past projects and programs. Inherent in the NASA culture is a respect for divergent viewpoints and innovative ways of doing things. This publication presents a wide variety of views and opinions. Good management is enhanced when program and project managers examine the methods of veteran managers, considering the lessons they have learned and reflected on their own guiding principles. Author

N89-12480# Texas Univ., Austin. Dept. of Management.
THE RELATIONSHIP BETWEEN TECHNOLOGY AND ORGANIZATIONAL STRUCTURES: EMPIRICAL TRUTH OR THEORETICIANS' WISHFUL THINKING Interim Report, May 1985 - May 1986
C. C. Miller, William H. Glick, Wang Yau-de, and George P. Huber Feb. 1988 49 p
(AD-A196606; ARI-RN-88-07) Avail: NTIS HC A03/MF A01 CSCL 05A

This research note reviews and analyzes the results of 34 empirical studies of technology-structure relationships. Previous reviewers have concluded that the across-study variation among sample correlations is attributable to differences in definition of technology, unit of analysis, and measurement strategy. These reviewers did not examine three theoretically important explanations for the mixed results: differences in: (1) organizational size, (2) degree of professionalization, and (3) organizational sector. Meta-analyses indicate that these previously unexamined explanations are important for understanding the technology-structure relationship. GRA

N89-12481# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN EXPERT SYSTEM MODEL OF ORGANIZATIONAL CLIMATE AND PERFORMANCE Ph.D. Thesis
James R. Holt 1988 246 p
(AD-A196872; AFIT/CI/NR-88-15) Avail: NTIS HC A11/MF A01 CSCL 12E

Application of computer technology has greatly increased the manager's ability to make informed decisions about inanimate resources (e.g., money, materials, equipment, space and time). However, very little has been done to automate decisions involving human behavior because of the complexities involved. This research uses a third generation expert system develop shell to create a prototype management consultant for behavioral issues. The frame-based, object-oriented expert system represents individuals and organizations in a decision support system. The expert system allows managers to make real time inquiries about the effect of changes in individual attitudes in specific organizations upon organizational performance. A survey questionnaire is developed to measure 133 individual attitudes. Selected organizational behavior and group dynamics findings are translated into 52 production rules. The rules are written as methods which are activated by the system following the structure of current behavioral models to predict performance. The system is validated by situational analysis. Individual attitudes are adjusted using fuzzy logic algorithms in 18 different situations, and the changes in calculated performance are compared with managers' predictions. Statistical analysis shows it is possible to predict changes in performance due to changes in attitude and circumstances. GRA

N89-12482# Computer Resources International A/S (Denmark).
EXPERT PLANNING SYSTEMS: A STUDY ON THE USE OF EXPERT PLANNING SYSTEMS FOR SPACE RELATED PLANNING APPLICATIONS Final Report
J. J. Fuchs, J. Guldberg, B. Olalainty, J. M. Darroy, and K. Currie Paris, France ESA 8 Apr. 1988 92 p
(Contract ESA-6982/NL-MAC)
(EP-CRI-FR-0001-1988; ESA-CR(P)-2634; ETN-88-93166) Avail: NTIS HC A05/MF A01

The potential of knowledge based planning systems in relation to ESA operations; a mock-up of a system for evaluation by the potential user group; and an engineering approach to develop expert systems for ESA are discussed. Planning of missions for Earth observation satellites was chosen as the potentially most useful case study. It is concluded that knowledge based approaches to planning are useful, but the operational characteristics of the system should be sufficiently fast so as not to hinder the planning personnel. This cannot be achieved within the knowledge engineering environment used for the mock-up construction; however, rewriting functions in LISP should alleviate the time performance inadequacies. For the engineering approach, the formalization of the development, accompanied by the creation of deliverable documents, creates a substantial overhead in contrast to the more conventional, and experimental manner of building expert systems. ESA

N89-12483# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

SENSORY SYSTEMS: A TACTICAL DECISION AID

B. J. P. vanderPeet and J. C. Donker 30 Jun. 1987 15 p
Presented at the 54th Panel Meeting/Symposium of the Avionics Panel of the Electrooptical Systems and Image Analysis for Airborne Applications, Athens, Greece, 5-9 Oct. 1987
(NLR-MP-87042-U; B8809138; ETN-88-93399) Avail: NTIS HC A03/MF A01

A general concept for a Tactical Decision Aid (TDA) for sensory systems to be used at airbase level is outlined. The TDA is based on a combination of algorithmic sensor performance prediction models and an expert system built with NEXT (NLR Engineering X-pert system Toolkit). It offers an interface between a user at airbase level and an existing sensor performance prediction model. A user can extract information from the TDA in the form of a dialog with the machine so that conclusions can be justified and sufficient input data can be assured. Different sources of information like results from sensor performance calculations, general sensor information, and information obtained from practical experience can be combined. ESA

N89-12484# Technische Hochschule, Aachen (West Germany). Fakultaet fuer Wirtschaftswissenschaften.

INTERNATIONAL PROJECT MANAGEMENT. ORGANIZATION OF INTERNATIONAL PROJECT COOPERATION IN LARGE INDUSTRIAL PROGRAMS AND IN THE SPACE INDUSTRY Ph.D. Thesis [INTERNATIONALES PROJEKTMANAGEMENT. GESTALTUNG DER GRENZUEBERSCHREITENDEN PROJEKTKOOPERATION IM GROSSANIANGENBAU SOWIE IN DER LUFT- UND RAUMFAHRTINDUSTRIE]

Heinz-Josef Herten 1987 401 p In GERMAN
(ETN-88-93234) Avail: NTIS HC A18/MF A01

Project cooperation possibilities and prospects in industrial programs and space industry are analyzed. Complexity and risks involved in multinational cooperation are analyzed in terms of insurance and liabilities of contractors and contractants. Management methods, financial aspects and technology transfer are reviewed. ESA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N89-12485# California Univ., Berkeley. Lawrence Berkeley Lab.

A FRAMEWORK FOR EXPRESSING AND CONTROLLING IMPRESSIONS IN DATABASES

Jaideep Srivastava and Doron Rotem Mar. 1988 24 p
(Contract DE-AC03-76SF-00098)
(DE88-014036; LBL-24894) Avail: NTIS HC A03/MF A01

There are many database applications in which substantial reduction in the costs of data management and query processing may be achieved if some imprecision in the stored data is allowed. In such applications, a precision requirement may be assigned to a query which implies that the error in the answer should not exceed some predetermined bound. The degree of imprecision in the database must be controlled such that a query always operates on data which is sufficiently accurate such that the computed answer meets or exceeds the precision requirements of the query. In this paper, the concept of precision in databases for both queries and data is introduced and formalized. Algorithms for maintaining a database at a specified degree of precision are presented and analyzed. We then describe how these algorithms may be employed for the purpose of choosing an optimal query plan by a query optimizer. DOE

N89-12486 Texas Univ., Austin.

DECISION-ORIENTED STRATEGIC PLANNING FOR INFORMATION SYSTEMS: APPLYING CONCEPTUAL MODELS OF CRISIS DECISION-MAKING TO STRATEGIC PLANNING FOR CRISIS MANAGEMENT DECISION SUPPORT SYSTEMS Ph.D. Thesis

Frederick Maximillia Bock, IV 1987 348 p
Avail: Univ. Microfilms Order No. DA8806296

Information systems to support decision-making in crisis situations are examined. In particular, it addresses the issue of developing a strategic plan for crisis information systems in an organization. A review of the nature of crises, current information systems planning approaches, and the role of conceptual models in crisis decision making is presented. It is argued that planning strategies grounded in time-stable process models of an organization are inappropriate for crisis information systems planning. As contrasted with emergencies, crises are neither stable nor predictable and lack well-definable processes upon which to base a plan. An alternative planning strategy is proposed based upon developing an information structure using conceptual models of crisis decision-making, particularly the Garbage Can Model of organizational choice proposed by Cohen, March and Olsen (1972). This alternative strategy, Decision-Oriented Strategic Planning for Information Systems (DSP/IS) is applied in a major military medical command; the application domain addressed is medical crisis management. The results are evaluated and then compared with the results of IBM's Information Systems Planning (ISP) process previously applied in the same command. Dissert. Abstr.

N89-12487 Iowa State Univ. of Science and Technology, Ames.

AN INVESTIGATION OF STORAGE AND COMMUNICATION CODES FOR AN ELECTRONIC LIBRARY Ph.D. Thesis

Mansour Alsulaiman 1987 448 p
Avail: Univ. Microfilms Order No. DA8805038

To investigate different codes that are to be used in compressing data in an electronic library system, an image data base, at the resolution of the IBM PC (640 x 200 x 2), that represents typical library materials was developed. The CCITT standard one- and two-dimensional compression techniques were applied to this data base and gave a compression factor (c.f.) less than the c.f. reported in the literature at higher resolution. The standards gave a very low c.f. for images that contain a lot of text. The Lempel-Zic-Welch (LZW) algorithm, which is usually used to compress text, was tried on the images. The LZW gave better c.f. for text only images and showed promising results for other types of images. Three different ways to optimize the LZW for compression of screens were investigated. Three different versions of modifying the LZW to recognize longer strings in the input were investigated and gave an improvement in the c.f. Two methods were proposed to scan a screen or read a scanned screen, that divide the screen into horizontal blocks and scan each block column by column. Dissert. Abstr.

N89-12488 National Academy of Public Administration, Washington, D. C.

FEDERAL INFORMATION RESOURCES MANAGEMENT: BRIDGING VISION AND ACTION

Sharon L. Caudle Jun. 1987 179 p
Copyright Avail: Issuing Activity

Information resources management (IRM) in federal cabinet-level executive departments and a random sample of bureaus under most of these departments is studied. An analysis of the perceptions of the managers and officials was performed. The study suggests three models for IRM in the federal government: an oversight model, a management model compared to the ideal IRM model in legislation and IRM founding documents, and a critical success factors model. Recommendations for practice are included. The study also recommends reasearch in the areas of information management, IRM skills, resource control, and program level IRM. B.G.

N89-12489 New South Wales Univ., Kensington (Australia).
STEREOTYPES OF INFORMATION SYSTEMS DESIGN: A LITERATURE REVIEW M.S. Thesis
Rodney W. Coyte 19 Feb. 1988 2 p
Avail: Issuing Activity

Computerized, formalized information systems (CFIS) in organizations are usually the products of particular approaches to their design. In turn, different approaches to design embody particular designer worldviews about the elements of systems design, the concept of the design process, and design criteria. It is argued that three stereotypical approaches to design incorporating particular worldviews can be identified in the literatures which address the design of CFIS in organizations. A survey of the CFIS design literature suggests this claim, and identifies differing levels of support for each stereotype over time. These findings have applications for the practice and teaching of CFIS design and provide a basis for further research to examine the relative success of differing approaches to CFIS design. Author

N89-12490# Perceptronics, Inc., Woodland Hills, Calif.
STRUCTURING KNOWLEDGE RETRIEVAL: AN ANALYSIS OF DECOMPOSED QUANTITATIVE JUDGEMENTS Interim Report, Apr. 1986 - Apr. 1987
Donald MacGregor, Sarah Lichtenstein, and Paul Slovic Jun. 1988 49 p
(Contract MDA903-83-C-0198; DA Proj. 2Q1-61102-B-74-F)
(AD-A197508; ARI-RN-88-42) Avail: NTIS HC A03/MF A01
CSCL 05B

Subjects were asked to estimate the answers to sixteen questions concerning uncertain quantities like: How many people are employed by hospitals in the U.S. under five different aiding conditions. The most-aided group (Full Algorithm) was given a complete algorithm and asked to make estimates for all the parts of the algorithm and to combine the parts as indicated to arrive at an estimate of the desired quantity. The second group (Partial Algorithm) was given the same algorithm without indications of how to combine the parts. After making estimates of the parts, these subjects then estimated the desired quantity. The third group (List and Estimate) were asked to list components of factors they thought were relevant, make an estimate of each item on their list, and then estimate the desired quantity. The fourth group (List) were asked to make such a list, but they were not asked to make estimates of each item before making an estimate of the desired quantity. The fifth group received no aid. The results generally showed improved performance in terms of both accuracy and consistency across subjects with increasing structure of the aid. GRA

N89-12491# Institut National Polytechnique, Grenoble (France). Lab. de Genie Informatique.
COMPLEX FORMS FOR MULTIMEDIA DATA BASES Ph.D. Thesis [LES FORMULAIRES COMPLEXES DANS LES BASES DE DONNEES MULTIMEDIA]
Christine Collet 1987 278 p In FRENCH
(ETN-88-93266) Avail: NTIS HC A13/MF A01

A model of complex forms combining the man-machine interface aspect with the improving of the flow of information is presented. An interactive forms manager procedure (GIF) was implemented. The method offers a formal environment to describe and treat the structure, the dynamics, and the object representation of any multimedia application. The approach allows a better management of the semantic integrity of the application and offers a homogeneous treatment of the objects of a data base. ESA

N89-12492# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
THE TRANSFER OF REQUIREMENTS TO CHARACTERISTICS OF INFORMATION SUPPLY
R. P. deMoel and J. J. P. vanHulzen 10 Jul. 1987 34 p In DUTCH; ENGLISH summary
(NLR-TR-87092-U; B8817905; ETN-88-93384) Avail: NTIS HC A03/MF A01

The development of information systems and the definition of user requirements are discussed. Correctness and completeness of user requirement cannot be guaranteed. A systematic approach following a requirements checklist reduces the risks of errors and omissions considerably. After their definition the requirements are to be translated into product characteristics. The coherence and mutual influences in requirements are traced in the functional design and technical concept phases of the development cycle. In these phases the measures which result in the required characteristics are defined. The approach adopted at the Netherlands National Aerospace Laboratory is introduced. This approach can lead to product certification for information systems. ESA

N89-12493# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
TECHNICAL CONCEPT FOR DATA MANAGEMENT SYSTEMS OF FLOW SOLVERS USING BOLA AS AN EXAMPLE
J. I. vandenBerg 9 Jul. 1987 31 p
(NLR-TR-87093-U; B8817437; ETN-88-93385) Avail: NTIS HC A03/MF A01

A concept for data management for computational fluid dynamics methods is outlined. It is applied for a boundary layer calculation method. It is shown that the required data management can be realized by using an existing data management and analysis system. ESA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N89-12494# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1989
Washington GPO 1988 127 p A report on S. 2209 presented by the Committee on Commerce, Science and Transportation, 100th Congress, 2d Session, 26 Jul. 1988
(S-Rept-100-429; GPO-19-010) Avail: US Capitol, Senate Document Room

Appropriations to NASA for research and development, space flight, control and data management, construction of facilities, and research and program management were examined and discussed. B.G.

N89-12495# Committee on Appropriations (U.S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT - INDEPENDENT AGENCIES APPROPRIATIONS FOR 1989. PART 7: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1988 1138 p Hearings before the Committee on Appropriations, 100th Cong., 2nd Sess., 19 Apr. 1988
(GPO-85-166) Avail: Committee on Appropriations, House of Representatives, Washington, D.C. 20515 HC free; SOD HC $29.00 as 552-070-040-64-1

This congressional report is of the hearings before a subcommittee of the Committee on Appropriations of the one hundredth congress of the House of Representatives. This particular part is related to authorizations for NASA. It includes statements from NASA's administration including Dr. James Fletcher. NASA's overall priorities and budget allocations are discussed in detail. E.R.

N89-12496# Committee on Science, Space and Technology (U.S. House).
INTERNATIONAL SPACE POLICY FOR THE 1990'S AND BEYOND, NO. 86
Washington GPO 1988 132 p Hearing before the Committee on Science, Space, and Technology, 100th Congr., 1st Sess., 10 Dec. 1987
(GPO-82-156) Avail: Subcommittee on Space Science and Applications, House of Representatives, Washington, D.C. 20510 HC free

The Subcommitteee on Space Science and Applications of the Committee on Science, Space and Technology of the U.S. House of Representatives met on 10 December, 1987, to discuss International Space Policy for the 1990's and Beyond. Expert witness was given by Herman Pollack, Chairman, NASA Advisory Council Task Force on International Relations in Space, Dr. James C. Fletcher, NASA Administrator, Michael Michaud, Acting Deputy Assistant Secretary for Science and Technology, Department of State, and Jerry Grey, Director, Science and Technology Policy, American Institute of Aeronautics and Astronautics. F.M.R.

N89-12497# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1989
1988 127 p Report on S. 2209 presented by the Committee on Commerce, Science and Transportation to the 100th Congress, 2d Session, 26 Jul. 1988
(S-Rept-100-429; GPO-19-010) Avail: Document Room, Senate, Washington, D.C. 20510 HC free

The Committee on Commerce, Science, and Transportation, to which was referred the bill (S. 2209) to authorize appropriations to the National Aeronautics and Space Administration for research and development, space flight, control and data communications, construction of facilities, and research and program management, and for other purposes, having considered the same, reports favorably thereon with an amendment in the nature of a substitute and recommends that the bill do pass. Author

N89-12498# Committee on Science, Space and Technology (U.S. House).
MULTIYEAR NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT
Robert A. Roe Washington GPO 1988 343 p Report together with supplemental views to accompany H.R. 4561 presented by the Committee on Science, Space and Technology, 100th Congr., 2nd Sess., 24 May 1988
(H-Rept-100-650; GPO-83-986) Avail: Document Room, House of Representatives, Washington, D.C. 20515 HC free

This congressional report is from the Committee on Science, Space, and Technology on Multiyear NASA Authorization Act. The Committee has taken a significant departure from its previous practice of authorizing appropriations for the Nation's space and aeronautics programs on an annual basis by setting three year funding levels. The authorization bill also establishes an aggressive set of goals and objectives for the next decade. These goals and objectives are detailed. E.R.

N89-12499# Committee on Appropriations (U.S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT - INDEPENDENT AGENCIES APPROPRIATION BILL, 1989
William Proxmire Washington GPO 24 Jun. 1988 112 p Report to accompany H.R. 4800 presented by the Committee on Appropriations, 100th Congr., 2nd Sess., 24 Jun. 1988
(S-Rept-100-401; GPO-86-442) Avail: Document Room, House of Representatives, Washington, D.C. 20510 HC free

The Committee recommends new budget authority of $59,076,473,000 for the Department of Housing and Urban Development, the Veterans Administration, the National Aeronautics and Space Administration, the Environmental Protection Agency, the National Science Foundation, and other agencies, commissions, boards, corporations, and offices. This amount is $409,701,000 above the budget request, $633,447,000 below the House allowance, and $2,373,579,000 more than the appropriation for fiscal year 1988. The following table summarizes the amounts recommended in the bill in comparison with appropriations for fiscal year 1988 and budget estimates for fiscal year 1989. For individual titles, see N89-12500 through N89-12500.

N89-12500# Committee on Appropriations (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
In its Department of Housing and Urban Development - Independent Agencies Appropriation Bill, 1989 24 Jun. 1988 p 63-71 (For primary document see N89-12499 03-84)
Avail: Document Room, House of Representatives, Washington, D.C. 20510 HC free

The FY89 NASA budgetary estimates are discussed for research and development; space flight, control, and data communications; construction of facilities; and research and program management. B.G.

N89-12501# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) AUTHORIZATION FOR FISCAL YEAR 1989
Washington GPO 1988 148 p Hearing before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, 100th Congress, 2d Session, 22 Mar. 1988, part 3
(S-Hrg-100-579-Pt-3; GPO-87-269) Avail: Subcommittee on Science, Technology and Space

The hearing of the subcommittee on Science, Technology and Space of the Committee on Commerce, Science, and Transportation of the U.S. Senate of the 100th Congress is presented. The second session on NASA authorization for fiscal year 1989 is presented with the prepared statement of James C. Fletcher, administrator of NASA. Also presented is the statement of the American Institute of Aeronautics and Astronautics, and the statement of Dr. Norris J. Krone, of the Advisory Committee on National Aeronautics, American Institute of Aeronautics and Astronautics. E.R.

N89-12502# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
AGREEMENT ON THE INTERNATIONAL SPACE STATION AND THE COLUMBUS PROGRAM. DOCUMENTATION [UEBEREINKOMMEN UEBER DIE INTERNATIONALE RAUMSTATION UND DAS PROGRAMM COLUMBUS. DOKUMENTATION]
22 Jul. 1988 95 p In GERMAN
(Rept-27/88; ETN-88-93226) Avail: NTIS HC A05/MF A01

Agreements between NASA, ESA, Japan, and Canada on the collaboration for the detailed design, development, operation, and use of the manned orbital space station of Columbus program are presented. Main points are listed and the texts of resolutions are given. ESA

N89-12503# Freie Univ., Berlin (West Germany). Fachbereich Rechtswissenschaft.
MILITARY USE OF OUTER SPACE IN PEACETIME, AND THE RELATIONSHIP TO GENERAL CIVIL LAW Ph.D. Thesis [DER WELTRAUM UND SEINE MILITAERISCHE NUTZUNG IN FRIEDENSZEITEN IM LICHTE DES VOELKERVERTRAGSRECHTS]
Thomas Beer 1987 259 p In GERMAN
(ETN-88-93239) Avail: NTIS HC A12/MF A01

Technical and scientific considerations on satellite dynamics are analyzed in relation to military use of outer space, dual purpose technologies, and observation satellites. Civil law is reviewed and the main limitations of military use of space are described. ESA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N89-12504*# Mechanical Technology, Inc., Latham, N. Y.
CONCEPTUAL DESIGN OF AN ADVANCED STIRLING CONVERSION SYSTEM FOR TERRESTRIAL POWER GENERATION Final Report
Jan. 1988 378 p Prepared in cooperation with Sanders Associates, Inc., Nashua, N.H., Thermacore, Inc., Lancaster, Pa. and Pioneer Engineering and Manufacturing Co., Madison Heights, Mich.
(Contracts DEN3-372; DE-AT04-85AL-33408)
(NASA-CR-180890; DOE/NASA/0372-1; NAS 1.26:180890; MTI-87-TR57) Avail: NTIS HC A17/MF A01 CSCL 10B

A free piston Stirling engine coupled to an electric generator or alternator with a nominal kWe power output absorbing thermal energy from a nominal 100 square meter parabolic solar collector and supplying electric power to a utility grid was identified. The results of the conceptual design study of an Advanced Stirling Conversion System (ASCS) were documented. The objectives are as follows: define the ASCS configuration; provide a manufacturability and cost evaluation; predict ASCS performance over the range of solar input required to produce power; estimate system and major component weights; define engine and electrical power condidtioning control requirements; and define key technology needs not ready by the late 1980s in meeting efficiency, life, cost, and with goalds for the ASCS. B.G.

N89-12505# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AN APPLICATION OF INTEGER PROGRAMMING IN MICROCOMPUTERS: THE PLANNING OF AN URBAN NETWORK OF ESTABLISHED TRADE RETAILERS
Acioli AntoniodeOlivo and Maria deLourdesNevesdeOKurkdjian Aug. 1988 13 p In PORTUGUESE; ENGLISH summary Presented at the 21st Brazilian Symposium on Operational Research, 17-21 Oct. 1988, Rio de Janeiro
(INPE-4684-PRE/1379) Avail: NTIS HC A03/MF A01

A method is presented for locating facilities in the urban structure. It evolves a model of integer zero-one programming like p-median problem. Good bounds are obtained by solving Lagrangian relaxation of p-median problem using a subgradient optimization method. The data obtained by photointerpretation are used to model the system as a network. Author

88 SPACE SCIENCES (GENERAL)

N89-12506# European Space Agency, Paris (France).
REPORT ON THE ACTIVITES OF THE SPACE SCIENCE DEPARTMENT Annual Report, 1986-1987
M. C. E. Huber, comp., A. Pedersen, comp., B. G. Taylor, comp., K.-P. Wenzel, comp., Brigitte Kaldeich, ed., and Norman Longdon, ed. Jun. 1988 141 p Original contains color illustrations
(ESA-SP-1099; ISSN-0379-6566; ETN-88-93158) Copyright Avail: NTIS HC A07/MF A01

Research in solar and heliospheric science; planetary and space science; and astrophysics is summarized. Comets; planetary dust and plasma; the magnetosphere; and the EXOSAT and IUE programs are discussed. ESA

N89-12507# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
[ACTIVITIES REPORT IN INTERPLANETARY PHYSICS] Annual Report, 1986 [RELAZIONE SULL'ATTIVITA' SVOLTA NELL'ANNO 1986]
Sep. 1987 96 p In ITALIAN
(IFSI-87-11; ETN-88-93458) Avail: NTIS HC A05/MF A01

Interplanetary environment includes the RETE and TEMAG onboard experiments for the TSS project and the analysis of data from the Giotto mission. Cosmic ray activities includes the implementation of a solar neutron observation device. Infrared astronomy activities include the design and implementation of the electronic equipment for the ISO experiment. Gravitational wave activities includes the development of a high Q transducer for the Frascatti gravitational antenna and the implementation of a capacitive transducer. ESA

N89-12508# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
RESEARCH PROGRAMS AND RELATED BUDGETS FOR 1987 [PROGRAMMI DI RICERCA PREVISTI PER IL 1987 E RELATIVI PREVENTIVI DI SPESA]
Sep. 1987 68 p In ITALIAN
(IFSI-87-12; ETN-88-93459) Avail: NTIS HC A04/MF A01

Interplanetary environment includes experiments onboard the TSS project and Soho and Cluster ESA missions. Cosmic rays activities includes the implementation of neutron observation, coming from solar filaments. Infrared astronomy activities include CO molecule observation, active galactic nuclei, and symbiotic stars. Gravitational wave activities includes the continuation of gravitational antenna development, the implementation of an onboard gravimeter for space missions and work on quantum nondemolition techniques for detecting gravitational waves. ESA

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N89-12509 Cornell Univ., Ithaca, N.Y.
A FABRY-PEROT FOR AIRBORNE INFRARED ASTRONOMY AND THE SIII EMISSION FROM THE GALACTIC CENTER Ph.D. Thesis
Paul Hamilton Graf 1988 171 p
Avail: Univ. Microfilms Order No. DA8804586

A Fabry-Perot spectrometer for infrared astronomy has been built for and used on NASA's Kuiper Airborne Observatory. This instrument produces very high resolution spectra (R=lambda/delta lambda less than or approx 15,000) between 15 and 50 microns. The Fabry-Perot uses free-standing metal mesh for its optical resonant cavity and servo-controlled motors to vary the transmitted wavelengths. The fine structure lines of (SiII) at 18.71 microns (M42) and 33.482 microns (M17) in Galactic HII regions and (SiII) at 34.816 microns (S106) in a photodissociation region (PDR) were observed with the Fabry-Perot. The distribution of the (SiII) 34.861 microns emission from within 5 parsecs of the Galactic center is measured with the Cornell high resolution grating spectrometer, which is also used as the order-sorter for the Fabry-Perot. The gas phase abundance of silicon within the neutral gas ring surrounding the Galactic center is 4.5 x 10 to the -6, implying a depletion factor of delta sub Si approx 7. The SiII 34.8 microns/OI 63.2 microns line ratio is independent of the emitting region temperature and density, so the relative abundance of SiII to OI may be determined directly. Dissert. Abstr.

N89-12510*# Princeton Univ., N. J. Dept. of Astrophysical Sciences.
INTERSTELLAR LINES IN THE SPECTRUM OF SUPERNOVA 1987a Final Report, period ending 14 Sep. 1988
Edward B. Jenkins and Charles L. Joseph 4 Oct. 1988 60 p
(Grant NAG5-1004)

(NASA-CR-183222; NAS 1.26:183222) Avail: NTIS HC A04/MF A01 CSCL 03A

The primary interest was to analyze the interstellar lines produced by gases along the line of sight which resides in the galactic plane and halo, as well as material in the Large Magellanic Cloud or the immediate environment of the supernovae. The ionization and fine-structure excitation of assorted atoms were intrepreted. The goal was to learn more about conditions in various regions of space and identify the probable origins for some velocity components whose locations were uncertain. Author

N89-12511 Sussex Univ., Brighton (England).
EMISSION LINE RADIO GALAXIES Ph.D, Thesis
Clive N. Tadhunter 1986 400 p
Avail: Univ. Microfilms Order No. BRDX81095

A combination of long-slit, narrow-band imaging and IUE observations are used to establish the properties of the ionized gas in and around a sample of nineteen emission line radio galaxies (ELRGs). The extended emission line regions (EELRs), which proved to be a common feature of ELRGs are studied. The EELRs are shown to have a wide variety of forms and kinematics. It is suggested that this variety reflects a number of different origins for the gas. The spectra of the EELRs show a marked similarity to those of the active nuclei with lines from species as diverse as O(0), O(++), and He(+) present in individual spectra. Photoionization by a continuum with a significant X-ray component is the most likely ionization mechanism, but it is not yet clear that the ionizing photons originate in the active nuclei. Under the assumptions that the nuclear continuum is isotopic, time independent, and has a power-law form it is shown that in many galaxies there is no evidence for the continuum required to produce the great H luminosities in the extended clouds. Apart from data on the extended emission line regions, spectra of the nuclear region are also presented. The variations in the broad emission lines emitted by the nucleus of 3C382 are studied in detail. Dissert. Abstr.

N89-12512 Leeds Univ. (England).
PRECISION CCD PHOTOMETRY OF GLOBULAR CLUSTERS Ph.D. Thesis
Richard Gareth Noble 1987 226 p
Avail: Univ. Microfilms Order No. BRD-80923

Color-magnitude photometry of the Galactic globular clusters are reviewed. A survey was made of recently-published color-magnitude photometry of globular clusters, and a self-consistent distance scale established for these data, using the method of subdwarf matching to the observed main sequences. The distances thus derived were combined with other published color-magnitude data to infer cluster ages and horizontal branch magnitudes. The relationship between cluster horizontal branch magnitude and metallicity is discussed. The photometric applications of charge coupled devices are reviewed giving particular attention to the acquisition and analysis of crowded field CCD images with globular clusters. Digital photometric techniques are discussed, including analytic profile-filling to stellar images. Dissert. Abstr.

N89-12513* National Aeronautics and Space Administration, Washington, D.C.
ATLAS OF GALAXIES USEFUL FOR MEASURING THE COSMOLOGICAL DISTANCE SCALE
Allan Sandage and John Bedke (Space Telescope Science Inst., Baltimore, Md.) 1988 462 p Prepared for Computer Sciences Corp., Baltimore, Md. Prepared in cooperation with Johns Hopkins Univ., Baltimore, Md.
(NASA-SP-496; NAS 1.21:496; LC-88-600056) Avail: NTIS HC A20; also available SOD HC $80.00 as 033-000-01020-6 CSCL 03A

A critical first step in determining distances to galaxies is to measure some property of primary objects such as stars of specific types, H II regions, and supernovae remnants that are resolved out of the general galactic star content. With the completion of the Mount Wilson/Palomar/Las Campanas survey of bright galaxies in 1985, excellent large-scale photographs of the complete Shapley-Ames sample were on hand. Most of the galaxies useful for distance scale calibration are in this collection. This atlas contains photographs of 322 galaxies including the majority of all Shapley-Ames bright galaxies, plus cluster members in the Virgo Cluster core that might be usefully resolved by the Hubble Space Telescope (HST). Because of crowding and high background-disk surface brightness, the choice of field position is crucial for programs involving resolution of particular galaxies into stars. The purpose of this atlas is to facilitate this choice. Enough information is given herein (coordinates of the galaxy centers and the scale of the photography) to allow optimum placement of the HST wide-field planetary camera format of approximately 150 arc-seconds on a side. Author

N89-12514 Southampton Univ. (England).
ULTRAVIOLET, OPTICAL AND INFRARED STUDIES OF GALACTIC BINARY X-RAY SOURCES Ph.D. Thesis
Bernard James Payne 1987 165 p
Avail: Univ. Microfilms Order No. BRD-80425

The subclass of galactic binary X-ray systems known as the Massive X-Ray Binaries (MXRB) was studied. One of the most striking properties peculiar to the MXRB is that they exhibit regular X-ray pulsations. The UV flux of three of these systems was examined to serach for modulations over intervals corresponding to the known X-ray pulse periods. The IUE satellite was used for this purpose; it was necessary to employ a special trailed observation mode in conjunction with specific data analysis techniques designed to optimize the sensitivity and temporal resolution available. These procedures are described in detail. The UV spectrum of the sources Vela X-1, A0535 + 26 amd 4U1145619 were sampled with resolution of approximately 1/10th of the respective pulse periods. Observations of the proposed counterparts of three hard X-ray transients are examined; it is shown that the most likely counterpart has a spectrum consistent with that of a Be star. The behavior of the H alpha emission is also found to be partly correlated with the IR decline; both are accounted for by the expulsion of a shell of material from the companion star. Finally the optical/IR counterpart of the EX02030 + 375 system is identified. Dissert. Abstr.

N89-12515# Sandia National Labs., Albuquerque, N. Mex.
HIGH ALTITUDE BALLOONS AND GAMMA RAY ASTRONOMY
Crawford J. MacCallum 1988 10 p Presented at the 4th SDIO/IST Pathways to Space Experimentation Workshop, Orlando, Fla., 12 Jul. 1988
(Contract DE-AC04-76DP-00789)
(DE88-014525; SAND-88-2126C; CONF-880788-1) Avail: NTIS HC A02/MF A01

The author's experience with scientific high altitude ballooning will be presented. Usefulness of satellite versus balloon platforms will be contrasted in the context of gamma ray astronomy. General principles of gamma ray astronomy instrumentation will be discussed and illustrated in terms of our current instrument, the Gamma Ray Imaging Spectrometer (GRIS). Some words about the supernova phenomenon and its necessity for the existence of life in the universe will be followed by a brief glimpse of our preliminary data from Supernova 1987a. DOE

N89-12516# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
OPTICAL PHOTOMETER WORKING IN THE UBVRI BANDS USING AN RCA C31034/A02 PHOTOMULTIPLIER [FOTOMETRO OTTICO OPERANTE NELLE BANDE UBVRI CON TUBO FOTOMOLTIPLICATORE RCA C31034/A02]
P. Baldetti, A. DiGiorgio, A. Morbidini, S. Nozzoli, R. Orfei, and P. Saraceno Aug. 1987 87 p In ITALIAN
(IFSI-87-10; ETN-88-93457) Avail: NTIS HC A05/MF A01

An astronomical photometer is described. The instrument includes a Peltier refrigeration cell, circular filters to define the photometric bands, and the interface systems between filter, diagram, and focal planes of two telescopes. Standard stars were observed to obtain the transformation coefficients towards the

Johnson and Cousins photometric systems. The data obtained in a single night are not accurate enough and must be repeated.
ESA

N89-12517# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
TELEVISION SYSTEM FOR THE ATTITUDE CONTROL OF THE ASIAGO (182 cm) AND IFSI (40 cm) TELESCOPES [SISTEMA TELEVISIVO DI PUNTAMENTO E GUIDA PER I TELESCOPI DI ASIAGO (182 CM) E DELL'IFSI (40 CM)]
P. Baldetti, G. Farina, D. Lorenzetti, A. Morbidini, S. Nozzoli, R. Orfei, P. Saraceno, R. DeDonno, and F. Strafella (Lecce Univ., Italy) Sep. 1987 65 p In ITALIAN
(IFSI-87-13; ETN-88-93460) Avail: NTIS HC A04/MF A01

The optical system, made with modular interchangeable elements allows the adjustment of the optical field dimension, and is fully automatic. The system is intended for the attitude control of an infrared photometer, but is designed to have multiple applications. In full Moon conditions the system can keep control pointed to stars of 13.5 magnitude. In dark conditions acceptable operation is obtained for 15 magnitude stars, the visibility limit being 17.
ESA

N89-12518# Consiglio Nazionale delle Ricerche, Frascati (Italy). Istituto di Fisica dello Spazio Interplanetario.
CCD IMAGE DATA ACQUISITION FOR THE 40 cm IFSI TELESCOPE INSTALLED AT MONTEPORZIO (ITALY) [SISTEMA ACQUISIZIONE IMMAGINI A CCD DELL'IFSI INSTALLATO AL 40 CM DI MONTEPORZIO]
G. Bellucci, V. Formisano, E. Amata, G. Natali, and G. Agnelli (Osservatorio Astronomico, Rome, Italy) Jan. 1988 57 p In ITALIAN Original contains color illustrations
(IFSI-88-1; ETN-88-93468) Avail: NTIS HC A04/MF A01

The sensor is based on a TH7882 matrix of 567 lines and 384 columns, with 23 x 23 micron pixels. The sensor is installed in a 150 K liquid nitrogen cryostat. A dedicated Z80 microprocessor carries out data acquisition and data processing. The modified infrared telescope is applicable to observations requiring wider angles, such as close galaxies and clusters.
ESA

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

N89-12519 Ohio State Univ., Columbus.
THEORETICAL ATMOSPHERES OF STARS IN THE BROAD LINE REGIONS OF ACTIVE GALAXIES Ph.D. Thesis
John Franklin Scott 1987 85 p
Avail: Univ. Microfilms Order No. DA8804102

Model atmospheres for main sequence stars illuminated by incident power law flux characteristic of the broad line regions of active galaxies are computed using the ATLAS 6 computer code. Modifications of the temperature correction algorithm are given to allow improved convergence of atmospheres subjected to these extreme conditions. It is found that while the calculated Lyman alpha/H beta ratio matches the observed values fairly well, H alpha/H beta is predicted to be approximately 0.5 which is low compared to observed values of 3 to 4. While this problem might be rectified by assuming a system of broad line emitters that is composed of both a stellar and more standard photoionized cloud component, the number of stars required to reproduce the observed flux in H beta is much too high to be realistic for these regions. This large space density might be reduced by lowering the stellar surface gravity of the models, thus increasing the stellar radius. The stellar radii are found to be unaffected by the heating due to incident radiation, since in these plane parallel atmospheres the effective gravity is correspondingly increased by the incident radiation pressure. In a more realistic spherical calculation, where the atmosphere is finite in extent, angular force gradients set up by the incident radiation pressure may promote atmospheric expansion perpendicular to the direction of the incoming beam, or perhaps mass loss through ablation.
Dissert. Abstr.

N89-12520 Texas Univ., Austin.
A TIME-DEPENDENT ANALYSIS OF THE BLANDFORD-ZNAJEK PROCESS AND ITS ASTROPHYSICAL APPLICATIONS Ph.D. Thesis
Seok Jae Park 1987 109 p
Avail: Univ. Microfilms Order No. DA8806395

The time-dependent aspects of the Blandford-Znajek process, which was proposed as the prime mover powering Active Galactic Nuclei (AGNs). In order to do this it is first necessary to establish a time-dependent model of an AGN. A semi-time dependent model of an AGN, which is constructed simply by including the effects of the mass accretion rate M sub + in the original axisymmetric, stationary model of an AGN is investigated. Assuming the mass influx to be a constant leads to a conflict with observation. Consequently we suggest that the evolution of AGNs must be driven by a rapid decrease of M sub + and that the evolution proceeds from Quasi-Stellar Objects to nuclei of Seyfert galaxies or radio galaxies. The probable M sub + evolution was estimated, and therefore, the probable evolution of the power output extracted from the magnetosphere of the central black hole, and the magnetic field strength. A rigorous time-dependent model of an AGN deriving all the time-dependent correction terms in the equations was established. The results suggest that the angular velocity of the magnetic field lines at the equator of the black hole must be close to that of the hole if a fraction of the field lines can penetrate the strong field region near the black hole. A mechanism was found for short term variability of AGNs from the time-dependent correction term of the power output extracted from the magnetosphere of the accretion disk.
Dissert. Abstr.

N89-12521 Maryland Univ., College Park.
A STUDY OF THE ENERGY SPECTRA OF THE MAJOR ION SPECIES IN THE RING CURRENT REGION OF THE MAGNETOSPHERE DURING GEOMAGNETIC STORMS Ph.D. Thesis
Lynn Marie Kistler 1987 300 p
Avail: Univ. Microfilms Order No. DA8808571

Using the University of Maryland/Max Planck Institute for Aeronomy Charge Energy Mass (CHEM) spectrometer on the AMPTE Charge Composition Explorer (CCE) spacecraft, the near equatorial storm-time energy spectra of four major magnetospheric ions H(+), O(+), He(+), and He(++) were examined approximately over the energy range 1 to 300 keV/e in the L-range 3 to 6. The data were obtained during the main phase of all geomagnetic storms with minimum Dst less than - 50 in the time period September 1984 to November 1985. During this period, the orbit of the CCE processed such that the full range of local times was covered. When the spectra are organized by local time, certain features emerge. In particular, there is a dip in the spectra of all ions at 10 to 20 keV/e in the drawn-to-noon sector, while in the noon-to-dusk sector the proton distribution function drops off sharply below approximately 5 keV. These spectra were compared with those predicted by a model of ion drift and loss in the magnetosphere. It was found that the spectra are most consistent with a Volland-Stern electric field with gamma = 2 and with a rotation of the nominal dawn-to-dusk electric field eastward by two hours local time. Charge exchange is found to be the dominant loss process during the main phase of the storm. There are some quantitative disagreements, however, which may be explained either by an additional loss process or by a modified drift model.
Dissert. Abstr.

N89-12522# California Univ., Berkeley. Lawrence Berkeley Lab.
THE DIALOGUE BETWEEN PARTICLE PHYSICS AND COSMOLOGY
Bernard Sadoulet Apr. 1988 92 p Presented at the SLAC Summer Institute on Particle Physics: Looking Beyond the Z, Stanford, Calif., 10 Aug. 1987

(Contract DE-AC03-76SF-00098)
(DE88-014684; LBL-25212; CONF-870821-15) Avail: NTIS HC A05

In the last decade, a very close relationship has developed between particle physics and cosmology. The purpose of these lectures is to introduce particle physicists to the many scientific connections between the two fields. Before entering into the discussion of specific topics, it will first be shown that particle physics and cosmology are completely interdependent. DOE

N89-12523 Arizona Univ., Tucson.
STAR FORMATION IN THE MONOCEROS OB1 DARK CLOUD Ph.D. Thesis
Michael Scott Margulis 1987 167 p
Avail: Univ. Microfilms Order No. DA8804181

A survey of the Monoceros OB1 dark cloud has been made for molecular outflows and young stellar objects. In all, nine molecular outflows and thirty far-infrared sources were identified in a portion of cloud composed of about 3 x 10 to the 4th solar masses of material. Statistical arguments suggest that 90 percent of the far-infrared sources actually are young stellar objects embedded in the cloud. If the star formation rate in the Mon OB1 cloud is roughly constant with time then molecular outflows in the cloud should be able to support it against collapse due to gravity. This suggests that the birthrate of outflows in the solar neighborhood is very high. In fact, regardless of considerations of cloud support, the large number of outflows indentified in the Mon OB1 cloud and the propensity of the youngest stellar objects in the cloud to be associated with outflows suggest that outflows have a high birthrate in the solar neighborhood and are part of a common stage in early stellar evolution. Dissert. Abstr.

N89-12524*# Fermi National Accelerator Lab., Batavia, Ill.
CROSS SECTIONS, RELIC ABUNDANCE, AND DETECTION RATES FOR NEUTRALINO DARK MATTER
Kim Griest Jun. 1988 53 p Prepared in cooperation with Chicago Univ., Ill. Sponsored in part by NASA and DOE
(NASA-CR-183362; NAS 1.26:183362; FERMILAB-Pub-88/74-A)
Avail: NTIS HC A04/MF A01 CSCL 03B

Neutralino annihilation and elastic scattering cross sections are derived which differ in important ways from previous work. These are applied to relic abundance calculations and to direct detection of neutralino dark matter from the galactic halo. Assuming the neutralino to be the lightest supersymmetric particle and that it is less massive than the Z sup 0, we find relic densities of neutralinos greater than 4 percent of critical density for almost all values of the supersymmetric parameters. We constrain the parameter space by using results from PETRA (chargino mass less than 23 GeV) and ASP, and then assuming a critical density of neutralinos, display event rates in a cryogenic detector for a variety of models. A new term implies spin independent elastic scattering even for those majorana particles and inclusion of propagator momenta increases detection rates by 10 to 300 percent for pure photinos. Z sup 0-squark interference leads to very low detection rates for some values of the parameters. The new term in the elastic cross section dominates for heavy, mostly spinless materials and mitigates the negative interference cancellations in light materials; except for the pure photino or pure higgsinos cases where it does not contribute. In general, the rates can be substantially different from the pure photino and pure higgsino special cases usually considered. Author

N89-12525# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
INTERPLANETARY-MAGNETOSPHERIC RELATIONSHIPS: DATA FOR BARTELS ROTATION N. 1825 TO 1974
M. Parisi, S. Pase, M. Storini, R. Buccellato, and A. Felici Jun. 1988 163 p
(IFSI-88-6; ETN-88-93473) Avail: NTIS HC A08/MF A01

The 27-day average values for the isotropic nucleonic intensity (mean cosmic-ray energy = 15 GeV) and Ap index are reported for the period December 10, 1966 to January 10, 1978, to study medium term variations during one solar activity cycle. Fifteen parameters involved in the interplanetary - magnetospheric relationships were selected so as to present them on hourly basis in a series of data plots. Potential applications of these physical quantities are discussed. ESA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N89-12526 Michigan Univ., Ann Arbor.
A ONE-DIMENSIONAL MULTI-SPECIES MHD MODEL OF THE IONOSPHERES OF VENUS AND MARS Ph.D. Thesis
Hiroyuki Shinagawa 1987 429 p
Avail: Univ. Microfilms Order No. DA8801418

The behavior of the ionospheric magnetic fields and ionospheric plasma of the dayside ionospheres of Venus and Mars was studied using a one-dimensional multispecies MHD model. The coupled continuity momentum and Maxwell's equations were solved simultaneously for the major ions and for the magnetic field. In the ionosphere of Venus, the calculated magnetic field profiles were in good agreement with observations obtained by the Pioneer Venus Orbiter magnetometer at all altitudes. Good agreement was also obtained between tha calculated and observed plasma densities for altitudes below 250 km, including the electron density ledge near 190 km in magnetized ionospheres. It was found that the magnetic field in the lower ionosphere is maintained by the magnetic flux transported from the magnetic barrier region by the downward plasma motion. The typical time scale for the decay of the magnetic field is about several hours. Dissert. Abstr.

N89-12527# Consiglio Nazionale delle Ricerche, Frascati (Italy). Istituto di Fisica dello Spazio Interplanetario.
FOURIER REAL TIME MICHELSON INTERFEROMETRY. AN EXPERIMENT FOR MARS 1994 ORBITER TO STUDY CHEMISTRY, ENERGETICS, AND TEMPERATURE OF MARTIAN ATMOSPHERE, DUST, AND SOIL WITH AN IR FOURIER SPECTROMETER
V. Formisano, A. Coradini, F. Capaccioni, A. Carusi, F. Angrilli, M. Coradini, E. Bussoletti, C. Barbieri, M. Rafanelli, and M. Combes (Observatoire de Paris-Meudon, France) et al. Mar. 1988 27 p
(IFSI-88-2; ETN-88-93469) Avail: NTIS HC A03/MF A01

A Michelson interferometer is proposed for the 1992 Mars orbiter mission. The experiment intends to cover the planet Mars with high resolution spectrometry covering the spectral range 1 to 50 microns. The general characteristics of the interferometer, the scientific goals, and the approach to implement the required instrumentation are discussed. The choice is a two channel interferometer with refrigeration limited to passive cooling. Fourier spectrometry allows simultaneous measurements of all resolved intervals and high luminosity. ESA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

N89-12528# National Center for Atmospheric Research, Boulder, Colo. High Altitude Observatory.
WHITE LIGHT SOLAR CORONA: AN ATLAS OF 1987 K-CORONAMETER SYNOPTIC CHARTS, DECEMBER 1986 - JANUARY 1988
D. G. Sime, C. Garcia, E. Yasukawa, E. Lundin, F. Hoffman, and P. Reppert Mar. 1988 87 p
(Grant NSF ATM-87-09659)
(PB88-214846; NCAR/TN-309/STR) Avail: NTIS HC A05/MF A01 CSCL 03B

The synoptic observing project of the High Altitude Observatory's Coronal Dynamics Program began on 5 August 1980. The data obtained for it are gathered by the Mark 3 K-coronameter located at the Mauna Loa Solar Observatory, Hawaii, and are published yearly in volumes of The White Light Solar Corona: An Atlas of K-Coronameter Synoptic Charts. The data, in form of synoptic charts, are extended at both the beginning and the end of each year to provide some overlap with the preceding and succeeding volumes. This is also necessary to provide a complete set of the data organized into Carrington rotations covering a specific time period, since the rotations do not coincide with the yearly calendar. Further, observations are made at the limb, and west limb passage occurs 14 days after east limb passage. Thus, an entire rotation's data requires more than 28 days to collect. As well as the synoptic maps, two additional sections designed to aid the user are included in the volume. As in previous Atlases, the Activity Report Summary for the year and the Polar Synoptic Charts are included. Also included is the Mauna Loa Solar Observatory Calendar for 1987. GRA

N89-12529*# California Univ., Berkeley. Space Sciences Lab.
COLLABORATIVE ANALYSIS OF SOLAR MAXIMUM MISSION, VENERA AND PROGNOZ SOLAR X-RAY BURSTS Semiannual Report, Feb. - Jul. 1988
Kevin C. Hurley Oct. 1988 10 p
(Grant NAG5-935)
(NASA-CR-183258; NAS 1.26:183258) Avail: NTIS HC A02/MF A01 CSCL 03B

Efforts centered on cross-calibrating the Solar Maximum Mission (SMM) HXRBS detector with the Venera 13/14 cosmic ray burst detectors. The event was divided into six time intervals, and the best fitting SMM and Venera 13 spectra were calculated for each interval, using the individual fitting routines for the two instruments. The results are presented and discussed. Author

N89-12530*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
MODELLING OF SOLAR MAGNETIC FIELD AND PROMINENCE STRUCTURES Final Report, 1 Oct. 1986 - 30 Sep. 1988
Shi Tsan Wu Oct. 1988 131 p
(Grant NAG8-085)
(NASA-CR-183306; NAS 1.26:183306) Avail: NTIS HC A07/MF A01 CSCL 03B

Using plasma theory, the interaction is studied between high frequency and magnetohydrodynamic (MHD) waves from which a set of coupling equations resulted. On the basis of this formalism, the modulation instabilities of an electromagnetic soliton in a current sheet are examined, and it is shown that there is a resistive instability at the onset of the magnetic field reconnection. This mechanism could be used to explain the onset of solar flares and prominences. To improve the resolution of vector magnetic fields at the sun's surface, state-of-the-art optics is examined to improve the design and fabrication of a new spaceborne solar vector magnetograph as part of the SAMEX (Solar Active Measurements Experiment) program. Author

N89-12531# California Inst. of Tech., Pasadena.
PROTON FLARES OF 1980-1986 Final Technical Report, 1 Mar. - 31 Dec. 1987
Harold Zirin Nov. 1987 5 p
(Contract N00014-87-K-0171)
(AD-A197701) Avail: NTIS HC A02/MF A01 CSCL 03B

Proton flares from 1980 through May 1986 were studied. The particle events (having proton flux of 10/sq cm/s/sr with energy greater than or = 10 MeV) and their associated flares are published by the NOAA Space Environment Service Center in the Solar Geophysical Data. A total of 39 proton events occurred during the time interval, of which 34 associated source flares were identified. Aspects of the 34 proton flares investigated in the study and the results are listed below: Active Regions in which Proton Flares Occurred; Proton Flares and Flares Associated with Interplanetary Type II Bursts; Hard X-ray Signatures; and The Proton Flare Scenario. GRA

N89-12532# Technische Univ., Munich (West Germany). Fakultaet fuer Physik.
NUMERICAL SIMULATION OF ARTIFICIAL ION CLOUD INTERACTION WITH SOLAR WIND Ph.D. Thesis [NUMERISCHE SIMULATION DER WECHSELWIRKUNG KUENSTLICHER IONENWOLKEN MIT DEM SONNENWIND]
Walter Sachs 1987 108 p In GERMAN
(ETN-88-93232) Avail: NTIS HC A06/MF A01

Interaction between hot high Mach number solar wind and artificial ion clouds is studied. Numerical simulation of this process is performed by a hybrid model of electrons and ions. Electrons are considered as a hydrodynamic continuum and applied to space plasma physics. A 2-D computer code is developed for the simulation and interpretation of the interaction mechanism between plasma clouds and solar wind. ESA

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N89-12533# Consiglio Nazionale delle Ricerche, Frascati (Italy). Istituto di Fisica dello Spazio Interplanetario.
COSMIC RAY NM-64 NEUTRON MONITOR DATA XV
N. Iucci, R. Buccellato, F. Re, F. Signoretti, C. Signorini, G. Villoresi, and N. L. Zangrilli Dec. 1987 56 p
(IFSI-87-19; ETN-88-93466) Avail: NTIS HC A04/MF A01

Pressure corrected data from the Rome neutron monitor and barometric pressure data are given in tabular form for the year 1986, together with the graphs of the corrected intensity. Details on the devices employed, operational mode, and data handling are given. ESA

99 GENERAL

N89-12534# Space Research Organization Netherlands, Utrecht.
[ACTIVITIES REPORT IN SPACE RESEARCH] Annual Report, 1987
Apr. 1988 186 p
(ETN-88-93444) Avail: NTIS HC A09/MF A01

Research in X-ray astronomy, infrared astronomy, solar science, ultraviolet and visual astronomy, gamma-ray astronomy, and sub mm astronomy is summarized. Dutch participation in ESA and other space programs is described. ESA

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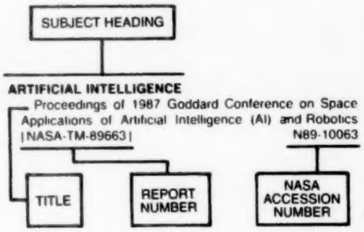
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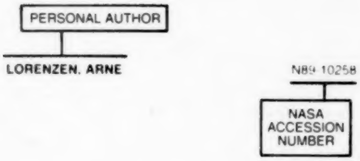

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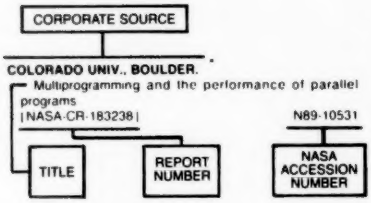

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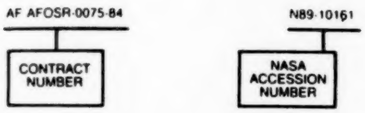

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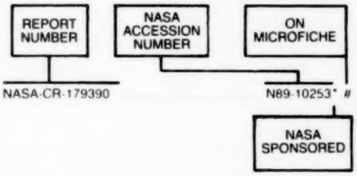

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JPL-TM-17 .... N89-12315* #

JPRS-JST-88-003 .... N89-11881 #

JPRS-UMS-88-008 .... N89-11810 #

JUEL-2171 .... N89-11850 #

KFK-4408 .... N89-12017 #

KNMI-WR-87-13 .... N89-12153

KSL-87-44 .... N89-11955 #

K535.88.RH-071 .... N89-12399 #

L-16416 .... N89-12316* #
L-16457 .... N89-11726* #
L-16468 .... N89-12237* #
L-16497 .... N89-12234* #

LAAS-88-155 .... N89-12001 #
LAAS-88-181 .... N89-12308 #
LAAS-88-199 .... N89-12466 #

LBL-24884 .... N89-12485 #
LBL-24949 .... N89-11860 #
LBL-25023 .... N89-11857 #
LBL-25173-REV .... N89-11842 #
LBL-25212 .... N89-12522 #
LBL-25278 .... N89-12476 #
LBL-25347 .... N89-12439 #
LBL-25394 .... N89-12045 #
LBL-25691 .... N89-12459 #
LBL-25732 .... N89-12458 #
LBL-25741 .... N89-12082 #

LC-88-600056 .... N89-12513*
LC-88-600514 .... N89-12037 #

LED-272 .... N89-11963

LFD-271 .... N89-11962

LPI-TRN-88-11 .... N89-11786* #

LRI-321 .... N89-12194 #

LRT-WE-9-FB(1987) .... N89-12020 #
LRT-WE-9-FB-6(1988) .... N89-12021 #

MBB-UT-116/88 .... N89-11741

MEMO-647 .... N89-12311 #
MEMO-713 .... N89-12348 #
MEMO-714 .... N89-12311 #
MEMO-715 .... N89-12341 #
MEMO-716 .... N89-12342 #
MEMO-717 .... N89-12353 #

MIPR-N85-16 .... N89-11918 #

MLM-3510(OP) .... N89-11858 #

MM-5488-88-6 .... N89-11900 #

MPIS-17/1987 .... N89-12375 #
MPIS-18/1987 .... N89-12376 #
MPIS-19/1987 .... N89-12018 #

MPL-TM-403 .... N89-12344 #

MPL-U-16/88 .... N89-12344 #

MSU-EE-FIN-9-88 .... N89-11792* #

MTI-87-TR57 .... N89-12504* #

MTL-TR-88-10 .... N89-11822 #
MTL-TR-88-12 .... N89-11864 #
MTL-TR-88-19 .... N89-11872 #

NADC-87179-60 .... N89-12203 #
NADC-88065-60 .... N89-11873 #

NAS 1.15:4077 .... N89-12234* #
NAS 1.15:88293 .... N89-12269* #
NAS 1.15:100338 .... N89-11791* #
NAS 1.15:100455 .... N89-11719* #
NAS 1.15:100626 .... N89-12267* #
NAS 1.15:100648 .... N89-11733* #
NAS 1.15:100677 .... N89-12104* #
NAS 1.15:100707 .... N89-12140* #
NAS 1.15:100712 .... N89-12228* #
NAS 1.15:100931 .... N89-12026* #
NAS 1.15:100987 .... N89-11790* #
NAS 1.15:101003 .... N89-11694* #
NAS 1.15:101004 .... N89-12207* #
NAS 1.15:101017 .... N89-12398* #
NAS 1.15:101020 .... N89-12192* #
NAS 1.15:101027 .... N89-11718* #
NAS 1.15:101204 .... N89-12158* #
NAS 1.15:101301 .... N89-11717* #
NAS 1.15:101316 .... N89-12283* #
NAS 1.15:101342 .... N89-11815* #
NAS 1.15:101346 .... N89-11912* #
NAS 1.15:101367 .... N89-12028* #
NAS 1.15:101377 .... N89-11913* #
NAS 1.15:101378 .... N89-12309* #
NAS 1.15:101384 .... N89-12337* #
NAS 1.15:101390 .... N89-12123* #
NAS 1.15:101394 .... N89-11911* #
NAS 1.15:101395 .... N89-11826* #
NAS 1.15:101404 .... N89-11804* #
NAS 1.15:101497 .... N89-11780* #
NAS 1.21:496 .... N89-12513*
NAS 1.21:6101 .... N89-12479* #
NAS 1.21:7037(230) N89-11692*
NAS 1.26:3922(22) .... N89-12166* #
NAS 1.26:4179 .... N89-11921* #
NAS 1.26:4191 .... N89-11698* #
NAS 1.26:166122-REV .... N89-12221* #
NAS 1.26:172095 .... N89-11793* #
NAS 1.26:177478 .... N89-11752* #
NAS 1.26:179497 .... N89-11808* #
NAS 1.26:179575 .... N89-11920* #
NAS 1.26:179600 .... N89-11809* #
NAS 1.26:179639 .... N89-11725* #
NAS 1.26:179650 .... N89-11803* #
NAS 1.26:180242 .... N89-12199* #
NAS 1.26:180890 .... N89-12504* #
NAS 1.26:181351 .... N89-12405* #
NAS 1.26:181705 .... N89-11753* #
NAS 1.26:181722 .... N89-11756* #
NAS 1.26:181725 .... N89-11740* #
NAS 1.26:181729 .... N89-12336* #
NAS 1.26:181730 .... N89-12027* #
NAS 1.26:182122 .... N89-11805* #
NAS 1.26:182169 .... N89-12010* #
NAS 1.26:182181 .... N89-11750* #
NAS 1.26:182188 .... N89-12122* #
NAS 1.26:182198 .... N89-11802* #
NAS 1.26:182224 .... N89-11751* #
NAS 1.26:182661 .... N89-12312* #
NAS 1.26:182998 .... N89-12121* #
NAS 1.26:183003 .... N89-11807* #
NAS 1.26:183004 .... N89-11827* #
NAS 1.26:183006 .... N89-12268* #
NAS 1.26:183222 .... N89-12510* #
NAS 1.26:183235 .... N89-12222* #
NAS 1.26:183236 .... N89-12003* #
NAS 1.26:183237 .... N89-12315* #
NAS 1.26:183256 .... N89-12039* #
NAS 1.26:183258 .... N89-12529* #
NAS 1.26:183306 .... N89-12530* #
NAS 1.26:183309 .... N89-12167* #
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NAS 1.26:183347 .... N89-12111* #
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NAS 1.26:183366 .... N89-12474* #
NAS 1.26:183368 .... N89-12366* #
NAS 1.26:183371 .... N89-12367* #
NAS 1.26:183396 .... N89-12282* #
NAS 1.26:183399 .... N89-12266* #
NAS 1.26:183507 .... N89-11792* #
NAS 1.26:184578 .... N89-12273* #
NAS 1.26:184579 .... N89-12246* #
NAS 1.55:3016 .... N89-11760* #
NAS 1.60:2595-REV .... N89-12114* #
NAS 1.60:2829 .... N89-12316* #
NAS 1.60:2837 .... N89-11726* #
NAS 1.60:2853 .... N89-12237* #
NAS 1.71:LAR-13988-1 .... N89-11814* #
NAS 1.71:MSC-21332-1 .... N89-11724* #
NAS 1.71:MSC-21366-1 .... N89-12206* #
NAS 1.77:20344 .... N89-12138* #
NAS 1.77:20381 .... N89-12015* #

NASA-CASE-LAR-12852-1 .... N89-11738*
NASA-CASE-LAR-13988-1 .... N89-11814* #

NASA-CASE-LEW-14297-1 .... N89-12048*

NASA-CASE-MSC-20873-1-SB N89-11961*
NASA-CASE-MSC-21332-1 .... N89-11724* #
NASA-CASE-MSC-21366-1 .... N89-12206* #

NASA-CP-3016 .... N89-11760* #

NASA-CR-3922(22) .... N89-12166* #
NASA-CR-4179 .... N89-11921* #
NASA-CR-4191 .... N89-11698* #
NASA-CR-166122-REV .... N89-12221* #
NASA-CR-172095 .... N89-11793* #
NASA-CR-177478 .... N89-11752* #
NASA-CR-179497 .... N89-11808* #

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NASA-CR-184579 N89-12246* #

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NASA-TM-101384 N89-12337* #
NASA-TM-101390 N89-12123* #
NASA-TM-101394 N89-11911* #
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NASA-TM-101404 N89-11804* #
NASA-TM-101497 N89-11780* #

NASA-TP-2595-REV N89-12114* #
NASA-TP-2829 N89-12316* #
NASA-TP-2837 N89-11726* #
NASA-TP-2853 N89-12237* #

NASA-TT-20344 N89-12138* #
NASA-TT-20381 N89-12015* #

NBS-SP-250-21 N89-12037 #

NBS-TN-1244-PT-1 N89-11831 #
NBS-TN-1317 N89-11942 #

NBSIR-88-3088 N89-12436 #

NCAR/TN-309/STR N89-12528 #

NCEL-TN-1783 N89-12083 #

NIKHEF-H/87-13 N89-12386 #
NIKHEF-H/87-14 N89-12387 #
NIKHEF-H/87-15 N89-12377 #
NIKHEF-H/87-16 N89-12378 #
NIKHEF-H/87-19-PT-2 N89-12379 #
NIKHEF-H/87-21 N89-12058 #
NIKHEF-H/87-22 N89-12380 #
NIKHEF-H/88-1 N89-12388 #
NIKHEF-H/88-2 N89-12381 #
NIKHEF-H/88-6 N89-12382 #

NIKHEF-K/APS/88-02 N89-12389 #

NIPER-313 N89-12126 #

NLR-MP-86061-U N89-12264 #
NLR-MP-87021-U N89-11712 #
NLR-MP-87022-U N89-11739 #
NLR-MP-87024-U N89-12023 #
NLR-MP-87025-U N89-12335 #
NLR-MP-87026-U N89-12024 #
NLR-MP-87027-U N89-12397 #
NLR-MP-87036-U N89-12265 #
NLR-MP-87038-U N89-12364 #
NLR-MP-87039-U N89-11713 #
NLR-MP-87041-U N89-11714 #
NLR-MP-87042-U N89-12483 #
NLR-MP-87046-U N89-11715 #
NLR-MP-87048-U N89-12091 #
NLR-MP-87061-U N89-12113 #
NLR-MP-87066-U N89-11716 #
NLR-MP-87067-U N89-11749 #

NLR-TR-87002-U N89-12363 #
NLR-TR-87021-U N89-12090 #
NLR-TR-87052-U N89-12263 #
NLR-TR-87059-U N89-11754 #
NLR-TR-87068-U N89-12025 #
NLR-TR-87074-U N89-11748 #
NLR-TR-87079-U-PT-1 N89-12396 #
NLR-TR-87092-U N89-12492 #
NLR-TR-87093-U N89-12493 #
NLR-TR-87132-U N89-12281 #

NOAA-NESDIS-21-VOL-1 N89-12105 #

NOAA-TR-NESDIS-41 N89-12137 #

NORDA-TN-384 N89-12165 #

NORDA-188 N89-12095 #

NPL-DITC-118/88 N89-12276

NRL-MR-6213 N89-11745 #
NRL-MR-6214 N89-12384 #

NSWC-TR-87-174 N89-12324 #

NUREG-CR-4266 N89-12037 #

NUSC-TD-8209 N89-12362 #

ONERA-RSF-3/3617-AY-012A N89-12032 #

ORNL/TM-10380 N89-12119 #
ORNL/TM-10706 N89-11917 #
ORNL/TM-10886 N89-12457 #

PB88-191168 N89-11690 #
PB88-194196 N89-12209 #
PB88-201264 N89-11885 #
PB88-201579 N89-12037 #
PB88-201603 N89-11831 #
PB88-208822 N89-12005 #
PB88-208962 N89-12195 #
PB88-214846 N89-12528 #
PB88-215439 N89-12436 #
PB88-225693 N89-11942 #

PD-CC-8706 N89-12232 #

PD-FM-8804 N89-11697 #

PD-SE-8810 N89-12238 #

PFC/JA-88-17 N89-12400 #

PML-1987-32 N89-11853

PNL-SA-15658 N89-12131 #
PNL-SA-15722 N89-12146 #
PNL-SA-15807 N89-12455 #
PNL-SA-15829 N89-12130 #
PNL-SA-15891 N89-12438 #

P136 N89-11947 #

R-86-158-VOL-2 N89-12081 #
R-86-159-VOL-2 N89-12081 #
R-86-160-VOL-2 N89-12081 #
R-2088 N89-11793* #

R/D-5180-EE-01 N89-12447 #
R/D-5857-PH.01 N89-12450 #

RADC-TR-86-218-VOL-2-PT-2 N89-12284 #
RADC-TR-87-250 N89-12225 #
RADC-TR-88-52 N89-12368 #
RADC-TR-88-53 N89-12448 #
RADC-TR-88-103 N89-11951 #

RAE-AW-28 N89-12275 #

RAE-MAT/STR-215 N89-11742 #
RAE-MAT/STR-221 N89-11743 #

RAE-MEMO-MAT/STR-1103 N89-11880 #

RAE-SPACE-671 N89-11784 #

RAE-TM-AERO-2124 N89-11744 #

RAE-TR-87077 N89-11742 #
RAE-TR-88004 N89-12275 #
RAE-TR-88017 N89-11743 #
RAE-TR-88035 N89-11784 #

REPT-M7-614800 N89-12075 #

REPT-3-45400/8R-66 N89-12055 #
REPT-5-88-WRAIR/ONR N89-12169 #
REPT-8/88 N89-11756* #
REPT-26/88 N89-12134 #
REPT-27/88 N89-12502 #
REPT-47-632/F N89-11908 #
REPT-86B0040 N89-12114* #
REPT-87-MA-08 N89-12195 #
REPT-87B0395 N89-12104* #
REPT-88-SRD-007 N89-11887 #
REPT-88-29 N89-12346 #
REPT-88-30 N89-12350 #
REPT-88-31 N89-12310 #
REPT-88-32-PT-2 N89-12339 #
REPT-88-33 N89-12347 #
REPT-88-35 N89-12351 #
REPT-88-36 N89-12033 #
REPT-88-37 N89-12352 #
REPT-88-38 N89-12340 #
REPT-88-177 N89-12433 #
REPT-88B-0260 N89-12140* #
REPT-153-6773-2 N89-12392 #

RFP-4246 N89-11867 #

RR-ONR-87-1 N89-12343 #

RR-88-24-ONR N89-12197 #
RR-718-M N89-12257 #
RR-722-M N89-12330 #
RR-729-M N89-12331 #

RSRE-MEMO-4121 N89-11855 #
RSRE-MEMO-4136 N89-11968 #
RSRE-MEMO-4143 N89-12467 #
RSRE-MEMO-4153 N89-11969 #
RSRE-MEMO-4158 N89-12274 #
RSRE-MEMO-4164 N89-12468 #

R05-87 N89-11921* #
R8806-1 N89-11956 #

S-HRG-100-579-PT-3 N89-12501 #

S-REPT-100-401 N89-12499 #
S-REPT-100-429 N89-12494 #
S-REPT-100-429 N89-12497 #

SACLANTCEN-SR-138 N89-12359 #

SAIC-88/1598 N89-12143 #
SAIC-88/1674 N89-11989 #

SAND-87-1343-VOL-11-NO-2 N89-11922 #
SAND-87-2053C N89-12006 #
SAND-87-2313C N89-11898 #
SAND-88-0064C N89-12404 #
SAND-88-0093C N89-12117 #
SAND-88-0435 N89-11990 #
SAND-88-0588C N89-11984 #

SAND-88-0913C .... N89-12050 #
SAND-88-1115 .... N89-12239 #
SAND-88-1318 .... N89-12056 #
SAND-88-1431 .... N89-12251 #
SAND-88-1729C .... N89-12052 #
SAND-88-2126C .... N89-12515 #
SAND-88-8941 .... N89-12252 #

SER-C-335 .... N89-12115

SERI/STR-211-3344 .... N89-12118 #

SERI/TP-217-3334 .... N89-11710 #

SESSIA-88-757 .... N89-11806 #

SG-RP-AI-024 .... N89-12022 #

SOL-88-4 .... N89-12249 #
SOL-88-14 .... N89-12250 #

SR-1 .... N89-12147 #

SSI-TR-132 .... N89-12147 #

STAN-CS-87-1178 .... N89-11955 #
STAN-CS-88-1210 .... N89-11987 #

T-3393 .... N89-11865 #

TD-87-3650 .... N89-11965 #
TD-87-4242 .... N89-12229 #
TD-87-5667 .... N89-11966 #
TD-87-5907 .... N89-11967 #
TD-87-6096 .... N89-11853

TM-AE-8802 .... N89-11695 #

TR-CIS-85-1 .... N89-12300 #

TR-4 .... N89-11834 #
TR-6 .... N89-11836 #
TR-7 .... N89-11837 #
TR-14 .... N89-11903 #
TR-25 .... N89-11905 #
TR-88-04 .... N89-12326 #
TR-88-08 .... N89-11847 #
TR-88-21C .... N89-12321 #

TR162 .... N89-12292 #

TSL-88-2 .... N89-12054 #

TW-280 .... N89-12334 #

UBUFFALO/DC/88/TR-72 .... N89-12452 #
UBUFFALO/DC/88/TR-79 .... N89-12372 #

UCB-PTH-88/12 .... N89-12476 #

UCID-21454 .... N89-12145 #
UCID-21482 .... N89-12248 #

UCRL-21059 .... N89-12129 #
UCRL-53866 .... N89-12303 #
UCRL-53867 .... N89-12044 #
UCRL-97716 .... N89-11869 #
UCRL-97811 .... N89-12157 #
UCRL-97937 .... N89-12235 #
UCRL-97981 .... N89-12133 #
UCRL-98088 .... N89-12132 #
UCRL-98303 .... N89-12233 #
UCRL-99265 .... N89-12042 #
UCRL-99324 .... N89-11843 #

UFTP-88-7 .... N89-12473 #

UILU-ENG-88-2225 .... N89-12253 #
UILU-ENG-88-2240 .... N89-11959 #

UMINF-134.87 .... N89-12210 #

US-PATENT-APPL-SN-028832 .... N89-11738*
US-PATENT-APPL-SN-060196 .... N89-11961*
US-PATENT-APPL-SN-213880 .... N89-12206* #
US-PATENT-APPL-SN-242253 .... N89-11724* #
US-PATENT-APPL-SN-250661 .... N89-11814* #
US-PATENT-APPL-SN-917125 .... N89-12048*

US-PATENT-CLASS-126-443 .... N89-12048*
US-PATENT-CLASS-126-901 .... N89-12048*
US-PATENT-CLASS-165-41 .... N89-12048*
US-PATENT-CLASS-165-904 .... N89-12048*
US-PATENT-CLASS-244-75-R N89-11738*
US-PATENT-CLASS-244-78 .... N89-11738*
US-PATENT-CLASS-342-374 .... N89-11961*
US-PATENT-CLASS-342-375 .... N89-11961*
US-PATENT-CLASS-343-777 .... N89-11961*
US-PATENT-CLASS-343-778 .... N89-11961*
US-PATENT-CLASS-343-779 .... N89-11961*

US-PATENT-4,770,232 .... N89-12048*
US-PATENT-4,772,893 .... N89-11961*
US-PATENT-4,773,620 .... N89-11738*

USAFETAC/DS-88/026 .... N89-12162 #
USAFETAC/DS-88/027-PT-A-F .... N89-12160 #

USARIEM-M-52/88 .... N89-12191 #

USARIEM-T-12/88 .... N89-12198 #
USARIEM-T-15/88 .... N89-12205 #

USMC-ROC-LOG-216.1.2 .... N89-11757 #

UTRC-927149 .... N89-12148 #

UVA/525375/MS88/103 .... N89-11871 #
UVA/525418/CHE88/102 .... N89-11863 #
UVA/527356/AM89/101 .... N89-12009 #

VKI-TN-165 .... N89-12034 #

VPI-E-88-29 .... N89-11827* #

VTRC-88-R11 .... N89-11885 #

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(503) 229-3673

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Harrisburg, PA 17105
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Austin, TX 78711
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